The MILWAUKEE ROAD

EF-4

"Little Joe" LOCOMOTIVES

By **Bill Wilkerson**

Publisher's note: This is the second edition of this book. The story copy is identical to the first publication. However, because of the death of Mr. Wilkerson, we no longer had access to the original photos in the book, so many substitutions have been made. Some of the original photos were re-scanned because of their importance to the story, but we were not able to get the quality we would have liked.

The "Little Joes"

EF-4

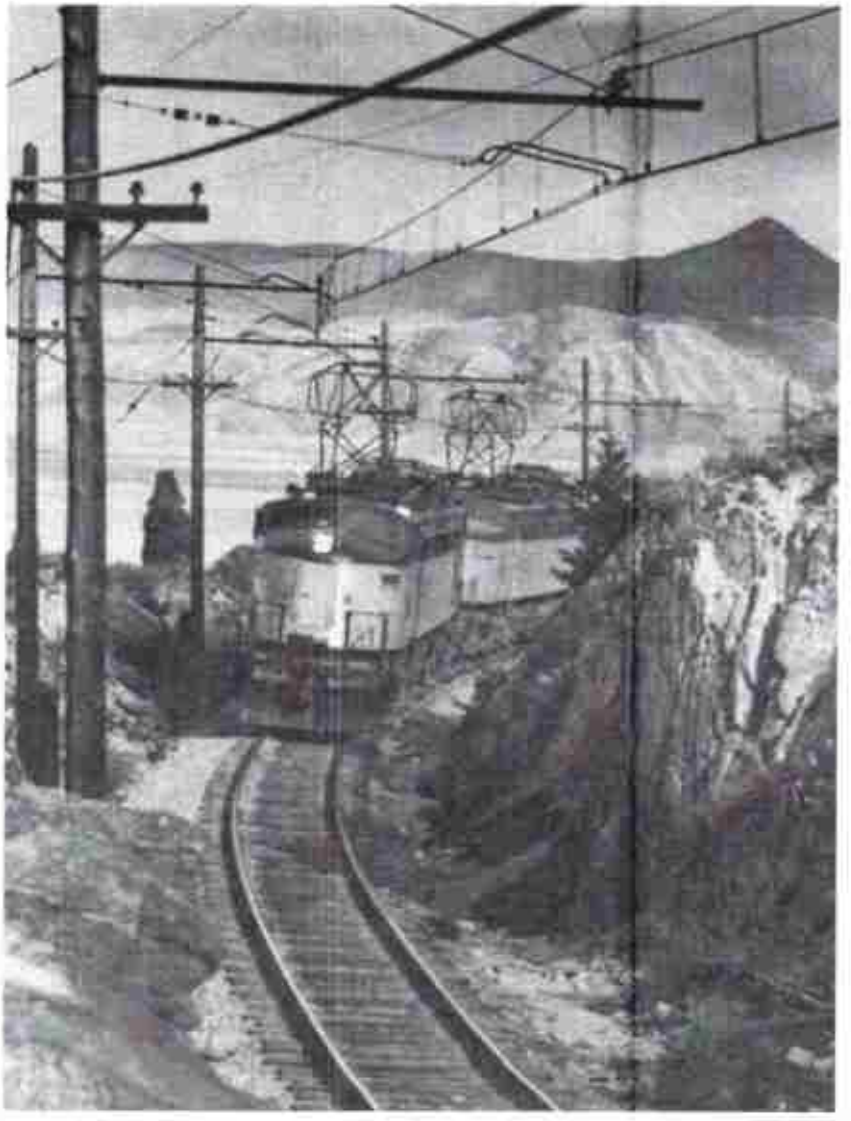
By *Bill Wilkerson*

Retired Milwaukee Railroad Engineer — Miles City, Montana

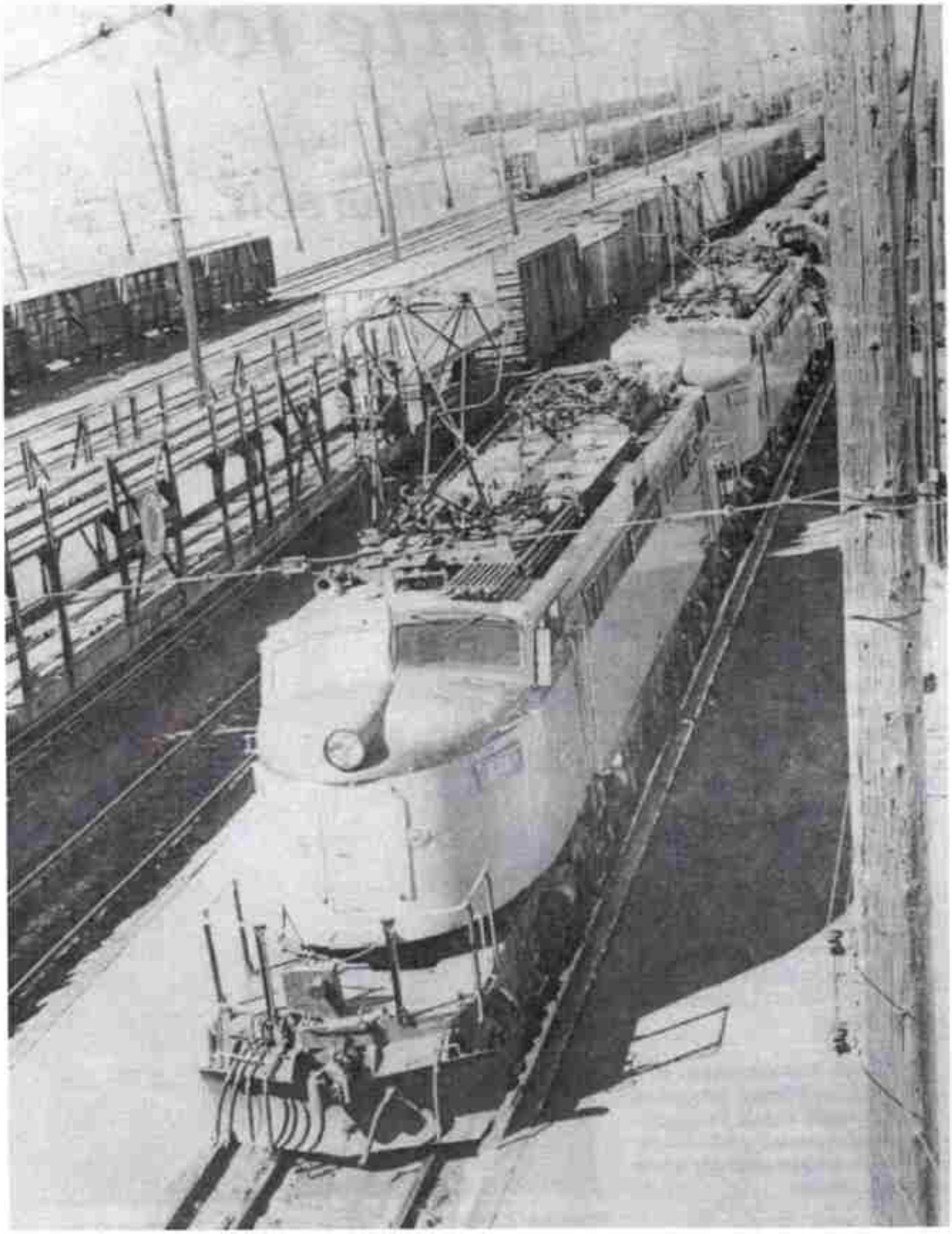
The EF-4 (Little Joes) were the most powerful and efficient single unit locomotives operated by the Milwaukee Road. In my estimation, they were the greatest machine any railroad ever coupled onto a train. The more I have dug into figures for this article, the more I'm convinced that my opinion is awfully close to right. By now most readers are probably thinking, "Fine, but what are you talking about and why name a locomotive Little Joe?"

"Little Joe" is a nickname that was given to the General Electric's electric locomotive No. 750 when it was on a four-month demonstration tour of the Milwaukee starting in December 1948. It was one of twenty locomotives built for Russia under a war recovery program, but was never allowed to be shipped to Russia. It is an interesting story and I'll give you the facts that I have been able to find before I describe the locomotives.

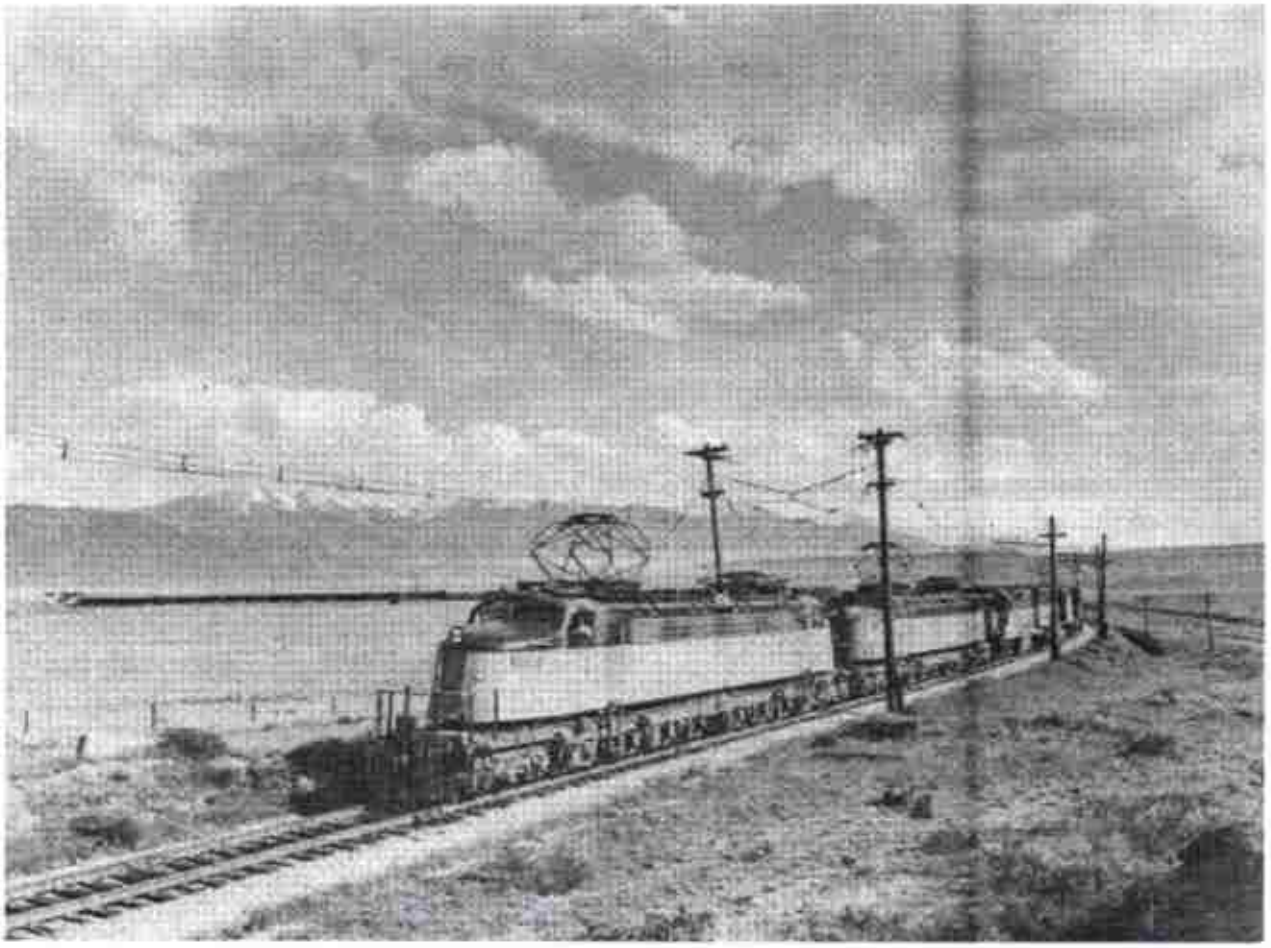
Under the provision of a postwar lend-lease program, Russia placed orders for equipment and material to rebuild its' railroads, and to electrify some strategic routes.



***Milwaukee E70/E79** leads Train No. 263 around the curves above Vendome, westbound on Butte Hill in the last days of electric operation. (The copyrighted photo was taken May 11, 1974 by Ted Benson, Box 1164, Modesto, California)*



E-76/E-79 and Diesels 3007, 3035 and 3009 *arriving in the Harlowton yards on March 22, 1974. Walter Smith was Engineer on this train. The picture was taken from the overpass which was located just west of the Harlowton depot.*
(Bill Wilkerson collection)



TRAIN No. 263 with E-78, E-70, 2060 4008, 16 at Vendome *on June 12, 1974. They were climbing a 2% grade (105.6 ft. per mile) on the east side of the Continental Divide — probably for the last time as they only had three days left.*
(Photo by Dick Dorn)

In March 1946 they placed an order for twenty large electric locomotives that were to operate on 3,300 volts of direct current and produce 5,500 horsepower. Engineering, design and manufacture of this order was contracted to General Electric's locomotive plant in Erie, Penn. The locomotives were to cost $270,000 each (the U. S. Taxpayers).

By September 1948, G. E. had completed eight locomotives, but the state department held up shipping permits because the Berlin crisis and the cold war were causing very strained relations.

In October 1948, President Truman ordered an embargo on all strategic material and equipment to the Soviet Union and the State Department canceled the contract for the twenty locomotives. By this time fourteen had been completed. Because most of the major components that were sub-contracted, such as frames, wheels and materials, were being delivered by the subcontractors and because you can't change plant schedules that easily, General Electric completed the last six to American gauge of 4' 8-1/2" instead of the Russian gauge of 5 feet. It was hoped the order could be sold to an American railroad, namely the Milwaukee. All they would have to do was raise the pantograph maximum height from 22 ft. 6-inch to 25 ft. six inches because the Milwaukee's trolley height ranged from 17' 6" (in tunnels) to 24' 2" maximum above the rail. Standard trolley line height was 24' 0" above the rail.

They were offered to the Milwaukee first because it used 3,000 volts and all their freight locomotives were 32 and 33 years old.

I have conflicting articles on the price and purchase agreement, so I'll give you both of

them. One is they offered all twenty to the Milwaukee for $1 million ("as is" at Erie). The other is they offered the fourteen Russian gauge engines ("as is" at Erie) for $1 million and wanted the Milwaukee to pay full price for the American gauge locomotives because according to that author, "so General Electric could recoup some of its loss."

Well, that might sound good to him, but General Electric or any company doesn't enter into contracts that big without proper safeguards for payment even if there is a cancellation, especially with the government. They have subcontracts out, material purchased and all the engineering and design work that has to be paid for. After the order was completed, their role was probably more of an agent disposing of surplus government property. After all, the contract was awarded through the State Department's program, and cancelled by them, so why should General Electric absorb any loss? They finished the contract.

By December 1948, locomotive No. 29927 was completed to American standards and turned over to the Milwaukee on December 24 as G. E. 750 for a four-month test period.

It had been built for the lighter wheel loading of the Russian railroad and encountered a lot of trouble on the mountain grades. It had the horsepower but didn't have the weight for traction on grades of two percent that climb 105.6 feet per mile, so experienced a lot of wheel slip problems.

It was being tested against the Milwaukee's three-unit 4,500 horsepower locomotives, but they exerted 172,750 lbs. of tractive effort compared to 106,000 lbs. for G. E. 750. It's just

EASTBOUND FREIGHT at Three Forks in 1971. *E-72 was the lead unit, followed by three GP-40's. The train was leaving for Harlowton via the rugged Sixteen Mile Canyon. (Photo by John Chase, Great Falls, MT 59401)*

like a 4-wheel drive pickup will pull more than a 2-wheel drive with more horsepower.

Even the two unit combination EF-1 had more tractive effort, 112, 750 from their 3,000 HP than the 750 could deliver from its' 5,110 HP that it developed on the 3,000 volt trolley line power.

In the late 1930's, the Milwaukee had converted twelve single units to "B" units for use in 3-unit and later 4-unit consists. On the B units, they used only the driving wheels with the two B units, they used only the driving wheels with the two stub frames, holding the driving wheels in the main frame. This gave them an overall length of 43 ft. compared to 54 ft. 8 inches, as originally built. On the B units they also cut off the control cab section, shortening it by 7 ft. 7 inches as built. On other B units, they left the unit intact and merely took the controls out of the cab and wired it for multiple unit control.

(See table below for a comparison of locomotive sizes.)

Because the 750 was being operated on 3,000 volts instead of the 3,300 it was designed for, the tests weren't too impressive. Everything was still labeled in Russian and soon the engine crews began to joke about Joe Stalin's little engine. Its' 88 ft. 10-inch length was a lot shorter than the three units at 168 feet, so it soon became the "Little Joe" and the name stuck.

After the Milwaukee got the twelve locomotives, raised the voltage to 3,400 and increased the weight, they were fantastic locomotives. They were well built, nicely proportioned locomotives of a modern, pleasing design. The 76' 8" body was made of welded steel with a cab on each end. The ends were streamlined and the cab windows sat high behind a short nose that slanted forward. A round headlight sat on top of the nose deck and flared back to the center post of the windshield. The cabs were big and roomy with a split windshield that slanted to the outside in a "V" and there were three side windows. The sides were smoothly welded with the air intake grillwork running along the top between the cabs. It stood 15' 5" from the rail to the top of the cab and 16' 6" to the locked-down pantograph, and it was 10' 7" wide. They had that smooth powerful look that I liked.

The body rested on two cast steel frames on center pin castings located between the No. 1 and No. 2 driving wheels in each frame. The frames were semi-permanently connected with an articulating joint under the center of the cab. This allowed the frames to move sideways several inches so it could negotiate a 16-degree curve (360 ft. radius), which is pretty sharp for a locomotive with a 4-8-8-4 wheel arrangement and a 77' 10" wheelbase.

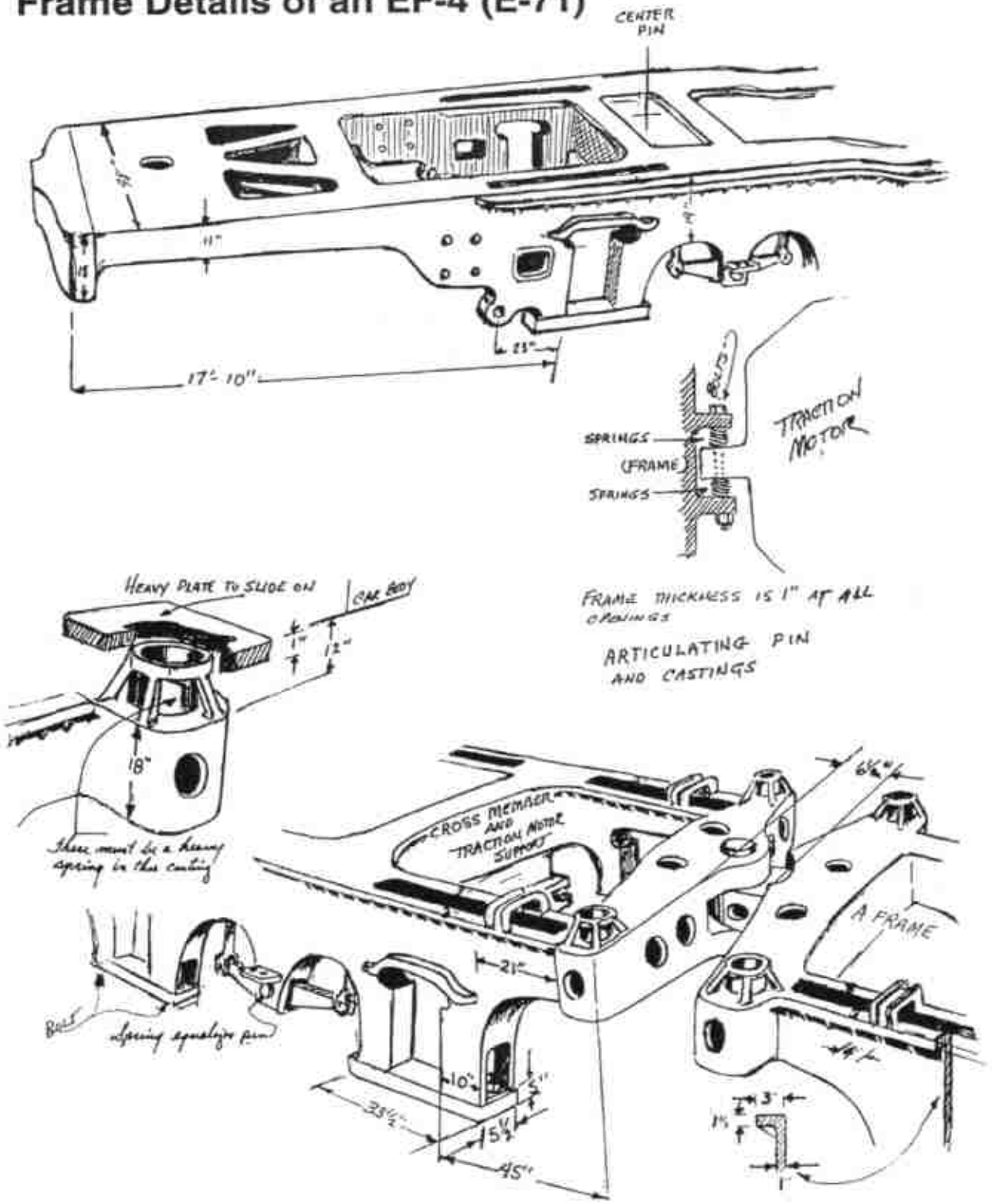
Each frame was cast in one piece, averaging about 41' 6" long. I don't have the exact length because the "A" frame had a male fitting and the "B" frame a female fitting for the articulating pin which made them different lengths. Each frame held eight driving wheels and four traction motors. On each end was a 4-wheel pilot truck

Listed below is a comparison table of locomotives being used at the time and the reason why G.E. 750 was classed as "little" by the employees.

Class	*Units*	*H.P.*	*Weight on drivers*	*Total Weight*	*Tractive effort*	*Length*
EF-1	2	3000	451,000	576,000	112,750	112'-0"
EF-2	3	4500	676,500	864,000	169,125	167"-6"
EF-3*	3	4500	691,000	816,000	172,750	155"-0"
EF-5	4	6000	927,500	1,172,2000	231,875	224"-7"
EF-5*	4	6000	931,000	1.056.000	232.750	210'-6"

*indicates "B" unit, or Bob Tail as they were called

Frame Details of an EF-4 (E-71)



(Drawn by Bill Wilkerson in Harlowton on May 4, 1973

EF-4s in the Harlowton yards, and a view of the overhead walkway which allowed pedestrians to safely cross over the yards to the south side where the roundhouse was located. (Bill Wilkerson photo)

A line-up of engines. (Bill Wilkerson photo)

that wasn't powered. These journals were roller bearings while the driving wheels had brass bearings. The Milwaukee replaced most of these with roller bearings on all twelve of its locomotives. This was the only major modification made to the Joes in their 24 years of service.

The 750 had eight General Electric model 750 traction motors which were the most powerful G. E. had built up to that time and is probably why they numbered the locomotive 750. Each traction motor produced 690 horsepower. They were series-wound direct current motors of the nose-mounted type. That means they were mounted on the axle with two suspension bearings on the front and the back was supported on a frame cross-member on spring supports to allow it to move up and down with the axle. The armature was geared to the axle with a 21-tooth gear turning the axle's 80-tooth gear.

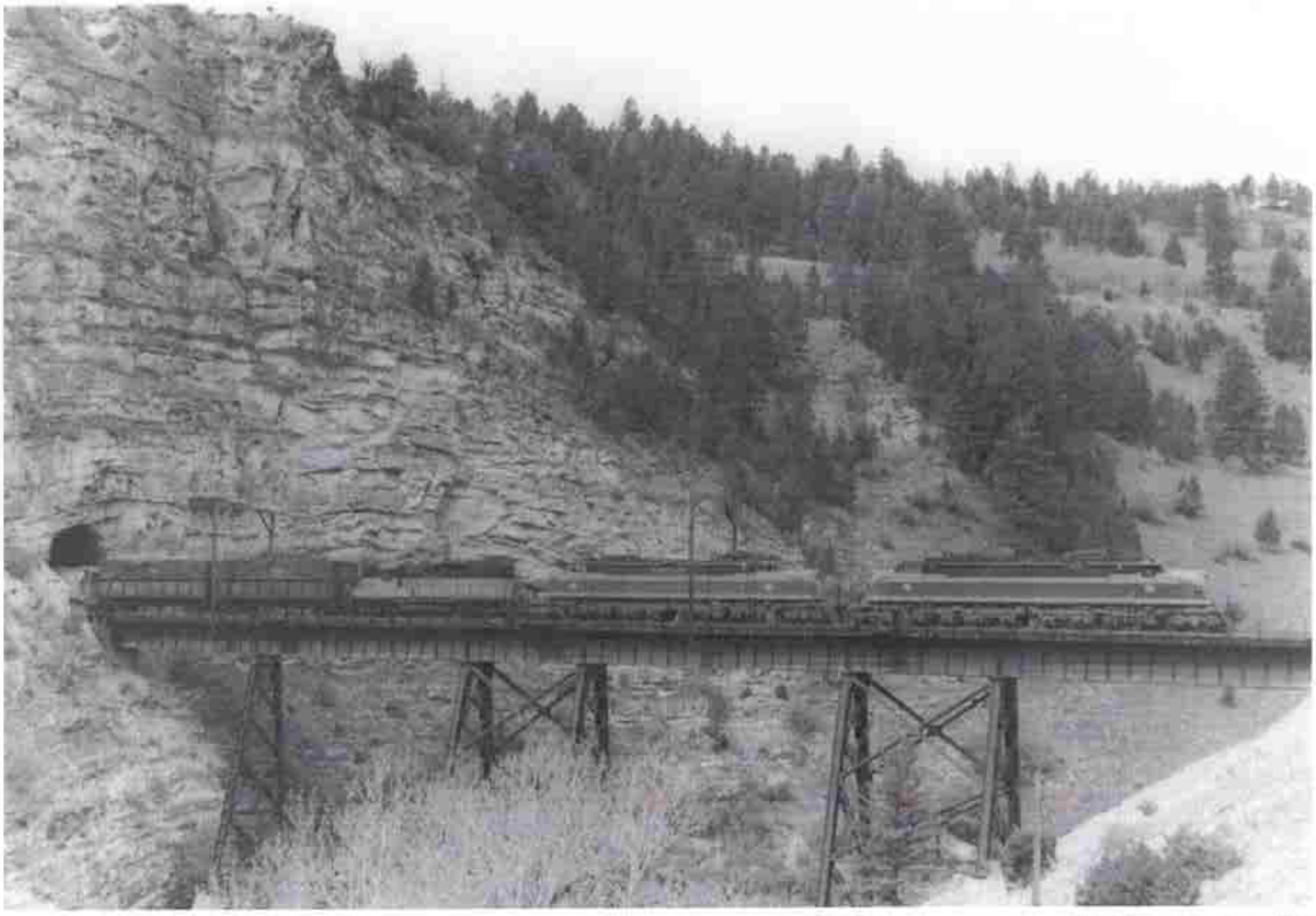
The Milwaukee didn't buy the twenty locomotives in 1949 because the chief mechanical officer argued that during the war in Europe he had seen many good electric locomotives standing idle because the trolley line was dead and he preferred the more versatile diesel locomotives. Management was caught in the diesel craze and were buying them as fast as they could so they could end steam operations as soon as possible.

I think the Milwaukee management figured that the government was stuck with the locomotives, so why pay $1 million for something they could probably get for nothing, or at least on a rental basis such as had been done during World War I. The other electrified railroads in this country were either alternating current, which wouldn't work, or were too small to need twenty locomotives of that size.

This is a classic example of the saying, "He who hesitates is lost." In this case, eight locomotives.

In the spring of 1949, the Chicago, Southshore and South Bend Railroad bought three locomotives for a reported $270,000. It is only a 73-mile long railroad, but the price was cheaper than they could have had small locomotives built.

This photo illustrates how complex the Joes were where it took four jumper cables between the units to make them work in multiple unit operation (the connectors are on the right side of the photo). The bottom cable is for diesels working behind the Joes. Any number of diesels could work off this cable. *(Bill Wilkerson photo)*



No. E-21 was running Extra when it came out of the Eagle Nest tunnel in Sixteen Mile Canyon on May 20, 1962. *(R. V. Nixon photo, Polson, MT)*

Their trolley line is only 1,500 volt D. C. as it is mainly an interurban railroad with mostly commuter trains between Chicago and South Bend, Indiana. They do have a pretty good freight business around the steel mills and coal hauling. Of interest to me was that they arranged the motor combinations to two sets of four-in-series and all eight parallel. This gave each traction motor the same voltage and power it would have had with the 3,300 volts they were designed for. I'll explain this later.

Brazil got five and widened the gauge to 5' 3" to run on their 3,000 volt railroad. I have never found any reference to a price on them so it must have been another government aid program. These are the only Joes operating after the spring of 1982. Neither of these railroads called their engines "Little Joes." I suppose they were by far the largest locomotives they had, so Little Joe just wouldn't fit.

In August 1950 the Milwaukee bought the last twelve and it still cost them $1 million and they had to do the conversion work in their Milwaukee, Wisconsin shops.

The two electric locomotives built by General Electric for the Great Northern Railroad in 1947 are classed as the largest single-unit electric locomotives built in this country, so any comparison of Little Joes will have to be against them. They were 101 feet long, were rated at 5,000 h.p. and exerted 119,000 lbs. tractive effort. The Joes were 88'-10" long, finally weighted 586,000 lbs., were rated at 5,530 H.P. and exerted 110,750 lbs. tractive effort.

To clarify the "finally weighed 586,000 lbs.," they were built weighing 545,000 lbs. To solve the wheel slipping problems, Chief Electrical Engineer Wylie increased the weight 41 tons. They poured concrete in

E-75 was taking on a load of sand at the sand tower in Harlowton. *(Bill Wilkerson photo)*

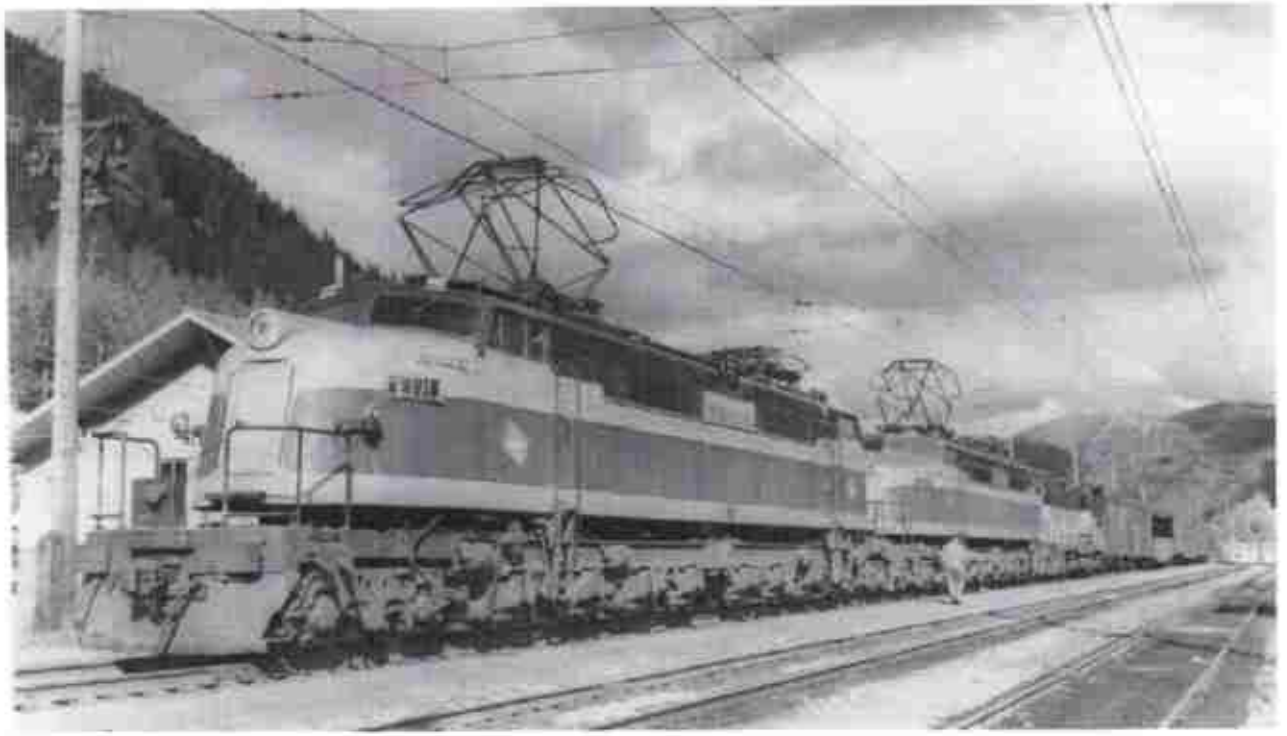
specially built pans under the pantographs and welded slab iron to the body frame and floors. This also increased the tractive effort from 106,000 to 110,750 lbs. Tractive effort is the force exerted by the driving wheels on the rail to move the train. Horsepower is the power to keep it moving and increase the speed. Horsepower goes up with speed, and tractive effort goes down.

The Great Northern locomotives had 24 driving wheels that were 42" in diameter and were powered by twelve traction motors rated at 450 h.p. each. The Joes had sixteen driving wheels 47-1/4" in diameter (120 centimeters), that were powered by eight traction motors rated at 690 h.p. each. Both locomotives operated with roughly a 4 to 1 gear ratio between the armature and the driving wheel axle, so in effect, the G. N. locomotives were driving in a lower gear (to put it in automobile language), which gave them more tractive effort. Figuring pound for pound, I think the Joes were more powerful. The G. N. locomotives had to be built heavier and longer to house the transformer and two synchronous motor generator sets which the Joes didn't need.

The Great Northern operated 71 miles of electrified railroad between Wenatchee and Skykomish, Washington, to get through the eight mile long Cascade tunnel. This was an 11,000 volt alternating current 25-cycle trolley line. On the locomotive the 11,000 volt current went through the transformer that cut it down to 1,350 volts single phase to run the two synchronized motor generators to furnish 600 volts direct current to the twelve G. E. 746 traction motors. These were standard diesel electric traction motors that were in production at the time. The synchronized motors turned at a constant speed and the power to the traction motors was controlled by the amount of excitation in the fields of the motor generators. They used direct current series wound traction motors because they are the most powerful starting and at slow speeds.

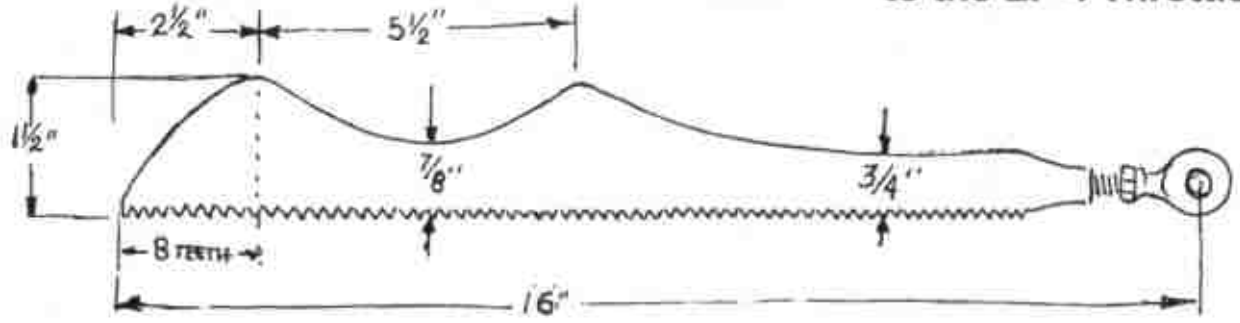
Using 3,400 volt direct current from the trolley line, the Joes didn't require the transformer and the motor generator sets that the G. N. locomotives needed to generate direct current for power to the traction motors. On the Joes, all the 3,400 volt trolley current could go to the traction motors through a complicated control system.

I'll try to explain the complexity and the reason why it was controlled the way they did as simply as I can in the hope that you'll understand what the

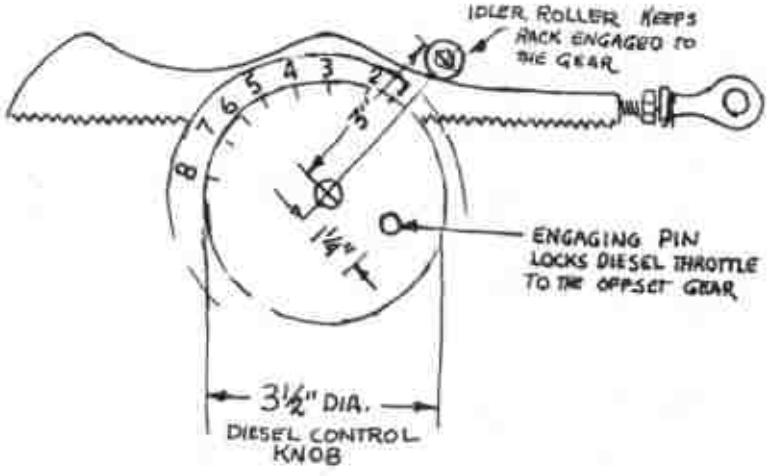


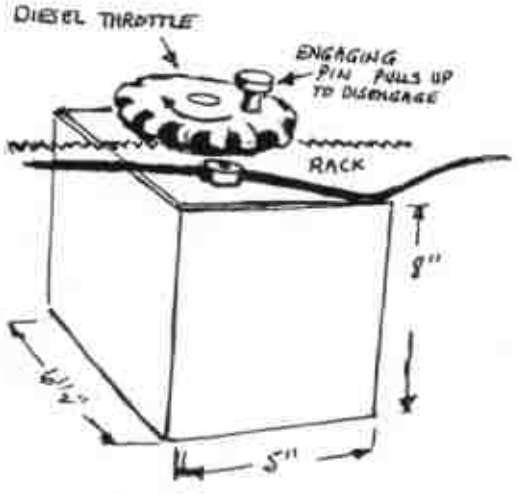
E-71 was the lead unit pulling Train No. 263 into Alberton in May 1962. (R. V. Nixon photo)

Diesel Throttle Connection to the EF-4 Throttle

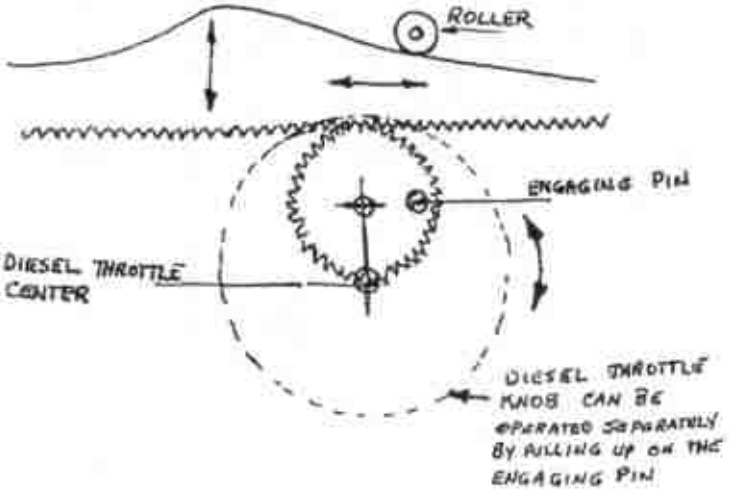


OFFSET GEAR USED SO MOTOR IS IN 16 (FULL SERIES) WHEN DIESEL IS IN No. 6 NOTCH.


IDLER ROLLER KEEPS RACK ENGAGED TO THE GEAR
8 7 6 5 4 3 2 1
1¼"
ENGAGING PIN LOCKS DIESEL THROTTLE TO THE OFFSET GEAR
3½" DIA.
DIESEL CONTROL KNOB



DIESEL THROTTLE BOX ON THE EF-4


ROLLER
ENGAGING PIN
DIESEL THROTTLE CENTER
DIESEL THROTTLE KNOB CAN BE OPERATED SEPARATELY BY PULLING UP ON THE ENGAGING PIN

Drawings by Bill Wilkerson

E-21, E-77 and 304 are coming out of Eagle Nest Tunnel in the Sixteen Mile Canyon on May 20, 1962.
(R. V. Nixon photo, Hamilton, MT)

engineer had to do to operate these giant electric locomotives.

The throttle on the Joes had 37 notches, compared to eight throttle notches on a diesel locomotive. Then there were two field shunt positions on another lever he had to use.

Starting out, the engineer had all eight traction motors in series. This means that the entire current passes through all eight traction motors from one to eight in succession, locking them together electrically so they all pull the same. His trolley line voltage is 3,400 volts which is too high for him to use starting, so he must send it through banks of resistors to cut it down before it gets to the traction motors. Otherwise it would be like shooting it off in a cannon, with no control. Volts equal pressure, like pounds per square inch, or water in a pipe and amps are compared to gallons. The more pressure, the more gallons that will flow through a pipe in a given time.

As the engineer notches out on the throttle from one to fifteen, he is reducing the amount of resistance in the line. Notch 16 is a free running notch with no resistors in the line. Now all 3,400 volts flow to the traction motors, but because they are in series, the eight traction motors cut the voltage down to 425 on each motor. In notch 17, he in effect shifts gears electrically, by changing his traction motor hook-up to Series Parallel with two sets having four traction motors in series in each set. From notch 17 to 25, he is again dropping out resistors in the line until he gets to notch 26. This is a free running notch for series parallel with no resistor in the line.

The four traction motors running in series now limit the voltage to 850 on each traction motor. Notch 27 he again shifts to a higher running position and now has four sets of traction motors with two motors in series in each set. From 27 to 36, he is again dropping out resistors with each notch. Notch 37 is a free running notch for parallel position. Now the two traction motors in series limit the voltage to 1,700 on each traction motor. There is no true parallel with eight independent motors as that would let the full 3,400 volts go to each motor and they are not designed for that volt-

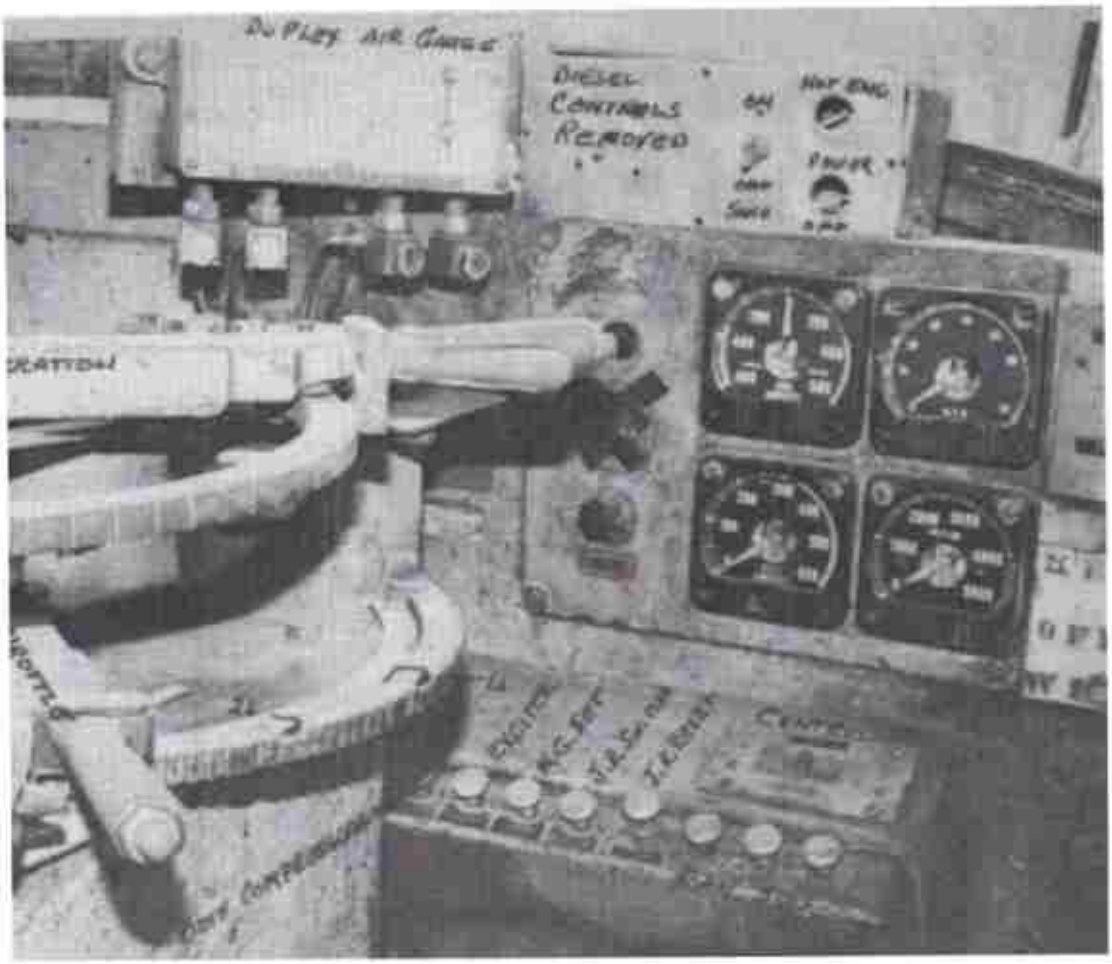
The E-70 located in a permanent display at Deer Lodge, Montana. *(Photo by Ed Lynch, August 13, 1994)*

age. This is his highest speed running notch on the throttle.

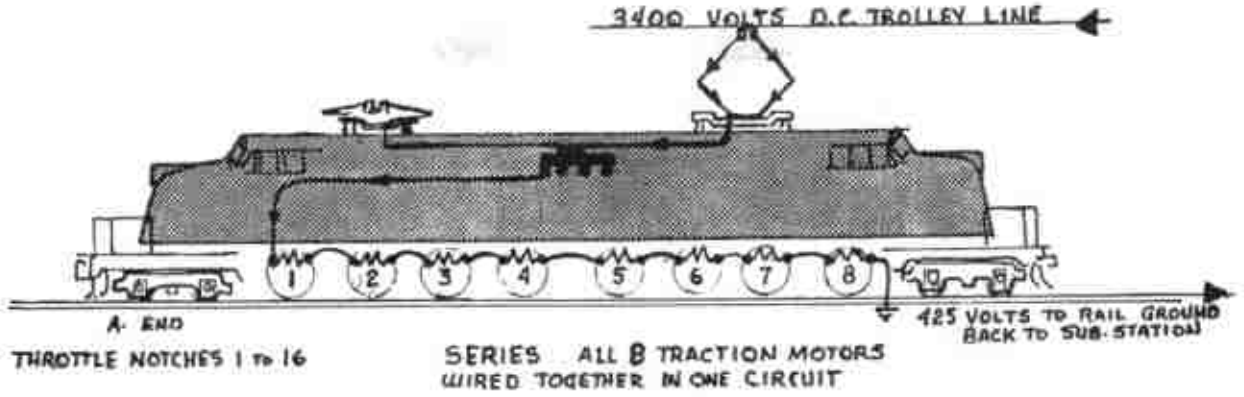
Because electric motors and generators are built the same and can function in either capacity, which they do on the Joes, we run into another problem that the engineer must overcome. Any electric motor, when its' armature starts to rotate in a magnetic field, will also begin to act as a generator and build up a resistance current called counter electromotive force (CEMF). This starts to neutralize the power being applied to the motor until the CEMF builds up strong enough where the voltage cannot push any more amps through the motor and the armature can't turn any faster. This is called the balancing speed. To overcome this problem, they would have to shunt the fields (reduce their magnetic strength). Because the current flows through the armature first, they split the current before it got to the field coils and run what is called an electrical shunt around the coil. By placing a resistor in the shunt, they would reduce the field coil strength by the amount of the resistor because electricity takes the path of least resistance. All the resistors and switches were housed in the car body, so they had to use four cables to hook up each traction motor. This way they ran the full current coming through the armature up to switches and resistors in the car body and the reduced current back in the field coils, which lowered the CEMF and allowed the voltage to push more amps through the armature so it could turn faster, until the CEMF would again balance it.

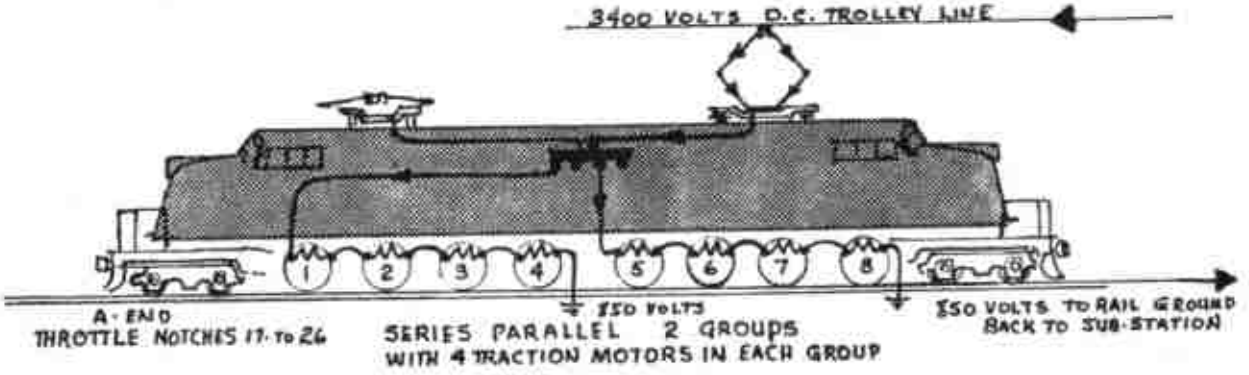
The Joes had two shunting positions that were controlled by the engineer. He could shunt in any of the free running positions, 16, 26 and 37, by moving the regenerating lever forward into either shunt position. An interlock on the throttle prevented him from shunting in any of the resistance notches and would kick the shunt out if he moved the throttle from any of the free running notches.

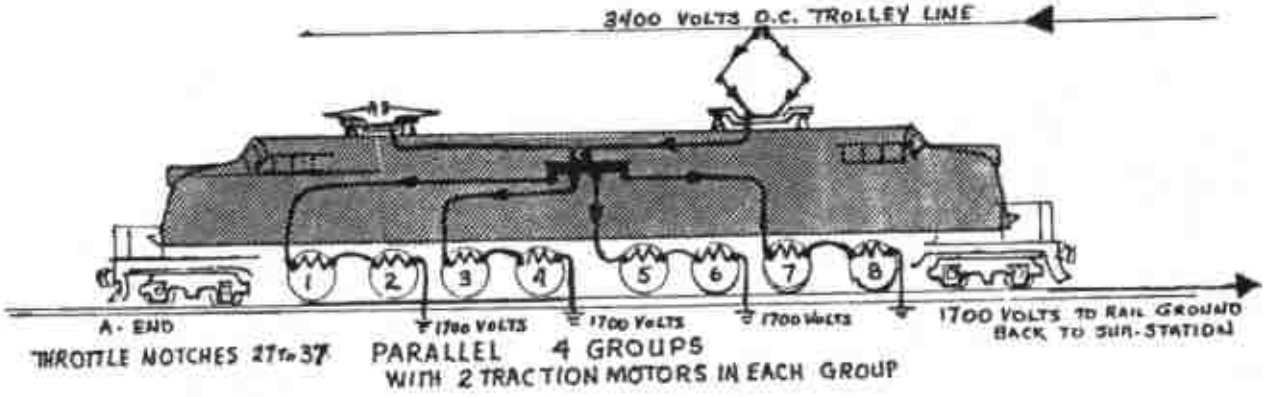
Sound complicated? Well it was, and to make it more interesting, the engineer had a time limit on how long he could stay in any of the resistance notches. This varied depending



37th notch Parallel Shunt in cab controls of EF-4







EF-4 Transition Illustrations

By *Bill Wilkerson*

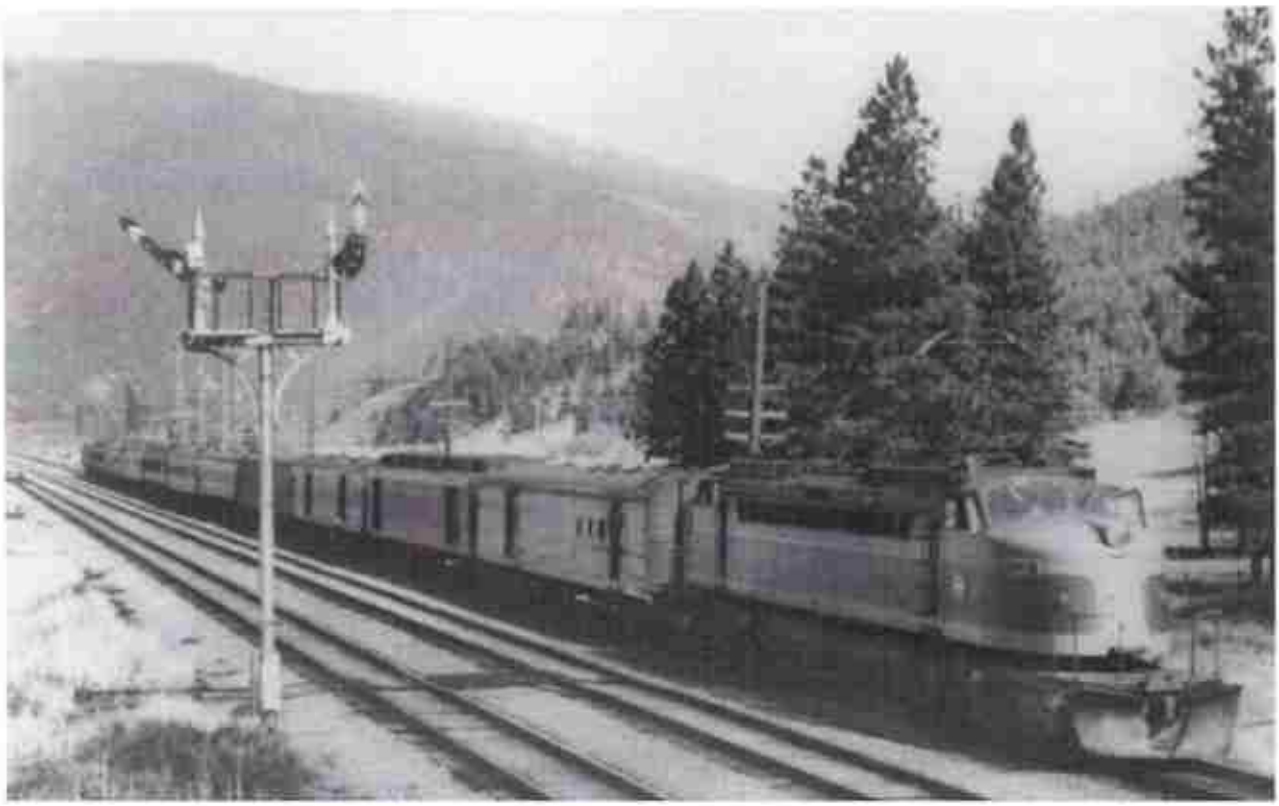
on the amps he was drawing and the cooling air temperature, but was usually one minute in each notch drawing full amps. That's why the colder the air the better the Joes could operate. All time limits were figured for full amps with a cooling air temperature of 77 degrees.

All of the above procedures are just for motoring (pulling). He had a different set of rules for regenerating (electric braking).

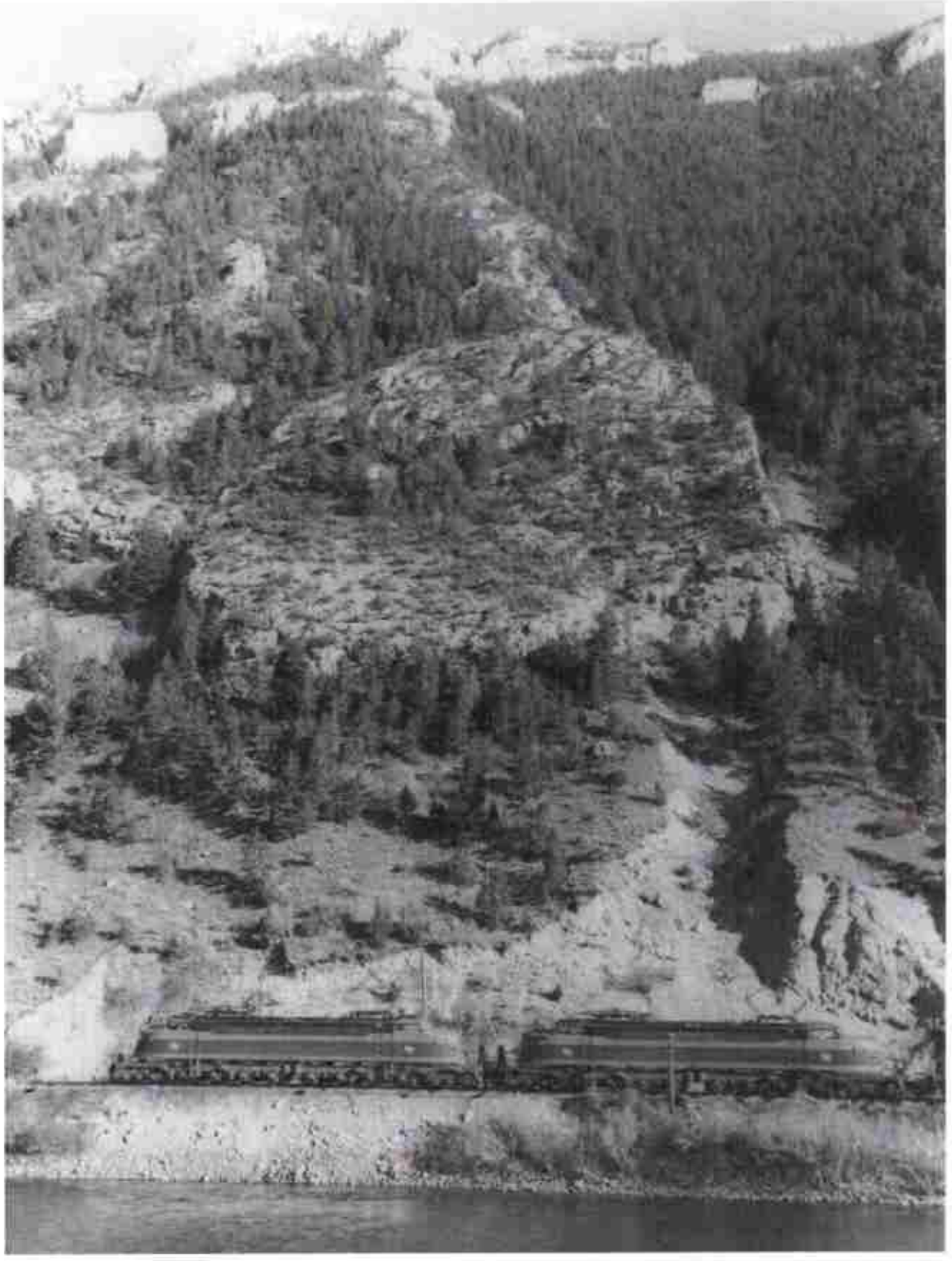
As he would start down a long grade, he would go into regeneration to electrically hold his train speed down to track conditions. Regeneration is using the traction motors as generators by separating the fields from the armature circuit and exciting the field circuit. This creates a magnetic field of controlled strength between the field poles that tries to stop the armature from rotating in it. The armature was geared to the driving axle, so the magnetic field trying to stop the armature exerted a braking action on the driving wheels to hold the train back.

As the traction motors are now generators, and the armature is being forced to turn in a magnetic field, they generate electricity that was returned to the trolley line. This current could either be used to help another train coming up the hill or sold back to the power company.

Because of the longer and steeper grades on the east side of the Continental Divide, they had lots of recorded evidence where they regenerated more power going down the east slope from Donald to Piedmont than it took to climb the west slope from Butte to Donald. The fireman had to record meter readings in each unit at the top and bottom of designated grades. The Milwaukee yearly figures always showed from 12 to 25 percent of the power returned, which in effect was free power any way you look at it. They never explained their figures, but to me "power returned," would have to be power that went back through the substation and was returned to the power company. Due to the minimum use contract with Montana Power Co., they never returned any to the power company.. Anything that went through the sub-station was extra profit for Montana Power, any power that helped another train was extra profit for the



Milwaukeee Train No. 17 was pulled by E-20 when this photo was taken on July 30, 1954, east of Missoula. There were very few photos taken of Little Joes on passenger trains as they were only assigned to that service for a short time.
(R. V. Nixon photo, Polson, MT)



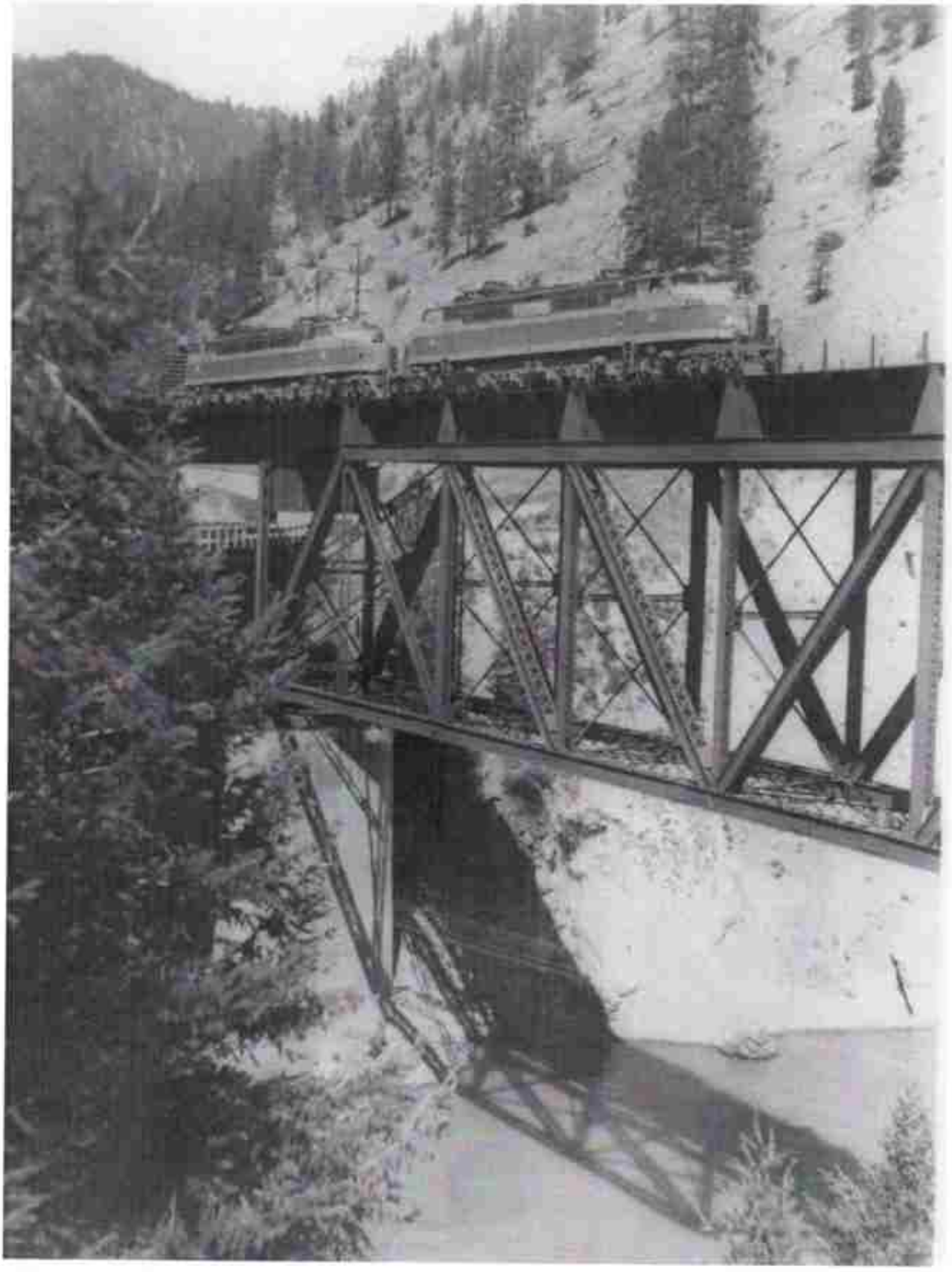
E78 and E79 were Eastbound in Jefferson Canyon on May 7, 1959. This was west of Alcazar.
(Photo by R. V. Nixon, Polson, MT)

The front end of E-79. (Bill Wilkerson photo)

Milwaukee. I don't think the electrical help one train would give another coming up the hill would show in these figures, especially if both trains were between substations. Anyhow, it was a big plus in the operating cost of the Milwaukee.

The regenerated power was just the tip of the iceberg. An even greater savings was from not having to replace burnt brake shoes and wheels and damaged cars, besides moving the trains a lot faster. The competing railroads using steam locomotives had to stop and set up brake retainers before starting down long grades, stop every so far to cool the wheels, stop at the bottom to release the retainers, besides the expense of replacing brake shoes and wheels. It takes a lot to hold a 5,000-ton train back on a two percent grade that drops 105.6 ft. per mile, but this expensive headache to the competition was money in the pocket for the Milwaukee through the electric locomotives regenerating power to help another train up the mountain. The engineers were able to control their train speed with regeneration alone and didn't have to worry about hot wheels. They only used their air brakes on the train when the speed got too slow for effective regeneration and this was almost stopped. They could regenerate down to around five miles per hour effectively in their lowest combination.

A much quoted 1924 report on electrification that the Milwaukee issued clearly showed the advantages of electric railroading. The electrification of the 660 miles of railroad over five mountain ranges in Montana and Washington from 1915 to 1920 including all equipment had cost $23 million. The steam power it replaced was valued at $7,400,000. The 440 miles from Harlowton to Avery had been completed in late 1917 and the 220 miles in Washington were completed in 1920. Even in that short time the savings to the Milwaukee had already been $12,400,000. Fifty-nine electric locomotives were doing the work that would have required 166 large steam locomotives and moving the trains twice as fast.



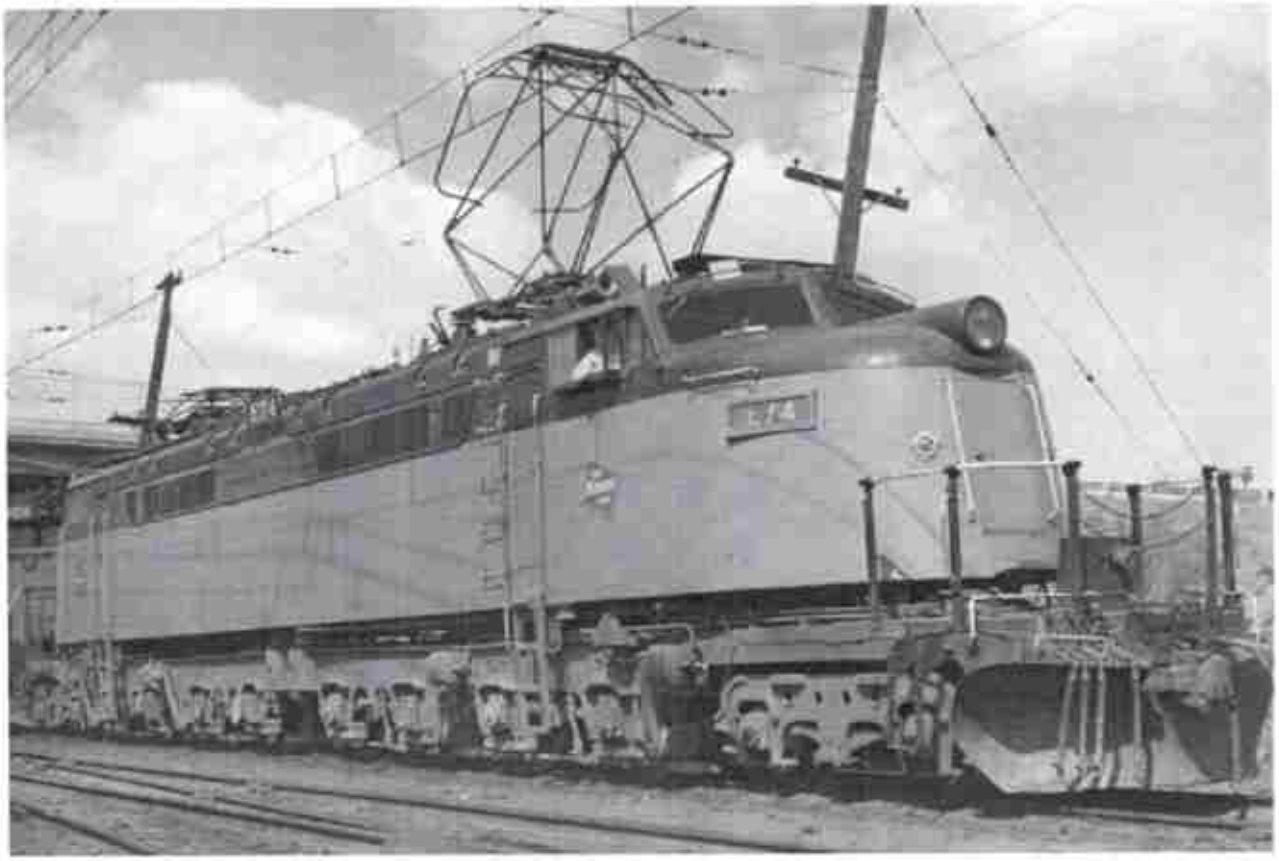
E-72 was running as an Extra when this photo was taken east of Tarkio on May 27, 1957. It was crossing the Clark Fork River at the time. (R. V. Nixon photo, Polson, MT)

The fuel savings for the year 1923 had been $1,271,793. Of course this report had been issued by a very competent management that was justly proud of their modern wonder railroad, and they had every right to be.

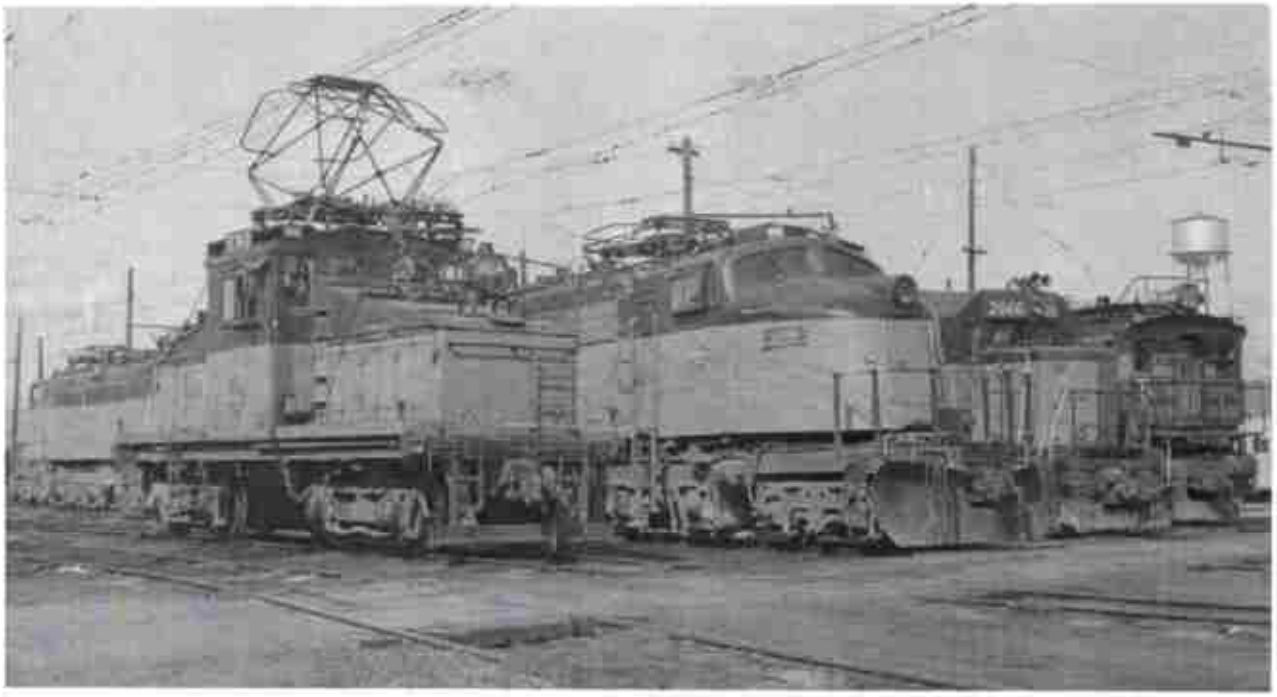
A further complication the engineers faced in regeneration was having to balance the load with the helper locomotive. The helper was usually cut in about the middle of the train to handle the back half of the train. Going down hill, both engineers would go into regeneration and had to balance the electrical load with each other. If one started regenerating too much, he would override the other locomotive and throw it into motoring (pulling) instead of braking. By feeling the train slack and watching their gauges, they could keep both locomotives regenerating the same amount and hold a steady speed down the steepest grades.

In 1957 they gave the Joe engineer more to worry about by hooking a diesel locomotive behind the electric locomotive to supply more power in the low voltage sag between the sub-stations. They rigged up a small diesel throttle that connected to the Joe throttle with a rack and offset gear. The diesel operated with just eight throttle notches compared to 37 on the Joe. The offset gear would bring the diesel into run 8 (wide open) when the Joe was in notch 16 (full series).

If the diesel started slipping, the engineer had to pull up on the engaging pin and turn the diesel throttle back to where it would hold until he got the Joe out where he could cut the diesel back in. Sometimes he had to work the diesel throttle separately on hard pulls if it got to



E-74 arriving at the west end of the Harlowton yards on April 14, 1974. Leonard Rice is the Engineer (Bill Wilkerson photo)



Bill Wilkerson created this composite. E-81 Class ES-2 Switch Engine, GE 1917; E-78 Class EF-4 "Little Joe" by GE, 1948; No. 2060, a diesel; E-50A Class EF-1, the first electric built in 1915 by GE.

slipping. He had a diesel wheel slip light in the Joe cab along with other diesel gauges and controls.

Whe he went into regeneration, he either had to cut out the diesel throttle if it didn't have dynamic brake, or use it along with the electric locomotive. Dynamic braking is the same as regeneration in using traction motors as generator to hold back the train and generate electrical current, only the current is wasted through heat in the iron grids and blown out in the air to keep the grids from burning out. The diesel is still burning about 12 gallons of fuel per hour to furnish excitation to the traction motors to generate current to be wasted.

Another big advantage with the electric locomotives is they don't lose power with altitude. If they developed 5,530 h.p. at sea level, they develop 5,530 h.p. going over Pipestone Pass at 6,347 ft. above sea level. A test made by the Southern Pacific Railroad with new 3,000 h.p. turbo-charged diesel locomotives showed that they were delivering just 60 percent (1,800 h.p.) goving over Donner Pass which is 6,752 ft. above sea level, only 405 feet higher than Pipestone Pass. These were the same class diesels the Milwaukee bought to replace the Joes.

On short time ratings, the Joes would develop much more than its' rated horsepower as shown in a report by Chief Electrical Engineer Barry Kirk. As near as I can figure out, this must have been two Joes with two or three diesel units. It had to be trouble in the first jumper cable or the diesel throttle on the Joe as that is about the only way you could lose all the diesel at the same time. Here is the report:

"I was riding over Butte hill when the diesels broke down on our eastbound train. It was a good day with a dry rail and no wind to blow the sand off the rails. We were right close to Janney substation, so I gave the engineer approval to keep going. Running with 475 amps per traction motor, those Joes pulled the train over the hill with no trouble. I did some calculating later that showed those Joes had to produce 6,700 to 7,000 h.p. with 30 percent adhesion to pull that train."

To show what those two Joes were really doing, I'll give you a little additional information. The operating instructions for the EF-4 Electric Locomotives (Joes) list that you could work 320 amps per traction motor continuously and 340 for a one hour period. The substation at Janney is 5,869 ft. elevation on a compensated grade of 1.66 percent which is climbing at 87.6 ft. per mile. It is seven miles from Janney to Donald with eighteen curves, seven of which

are eight degrees (720 ft. radius). The others are six degrees (1,080 ft. radius) and four degrees (1,440 ft. radius), all with 2-1/2 inch elevation on the outside rail above the inside rail and there are four tunnels, in fact, everything that makes a train hard to pull! The bind of the wheel flanges on the curves makes it just about as hard to pull as the 1.66 percent grade. There is no place where there is 1/2 mile of straight track. Just one curve into another.

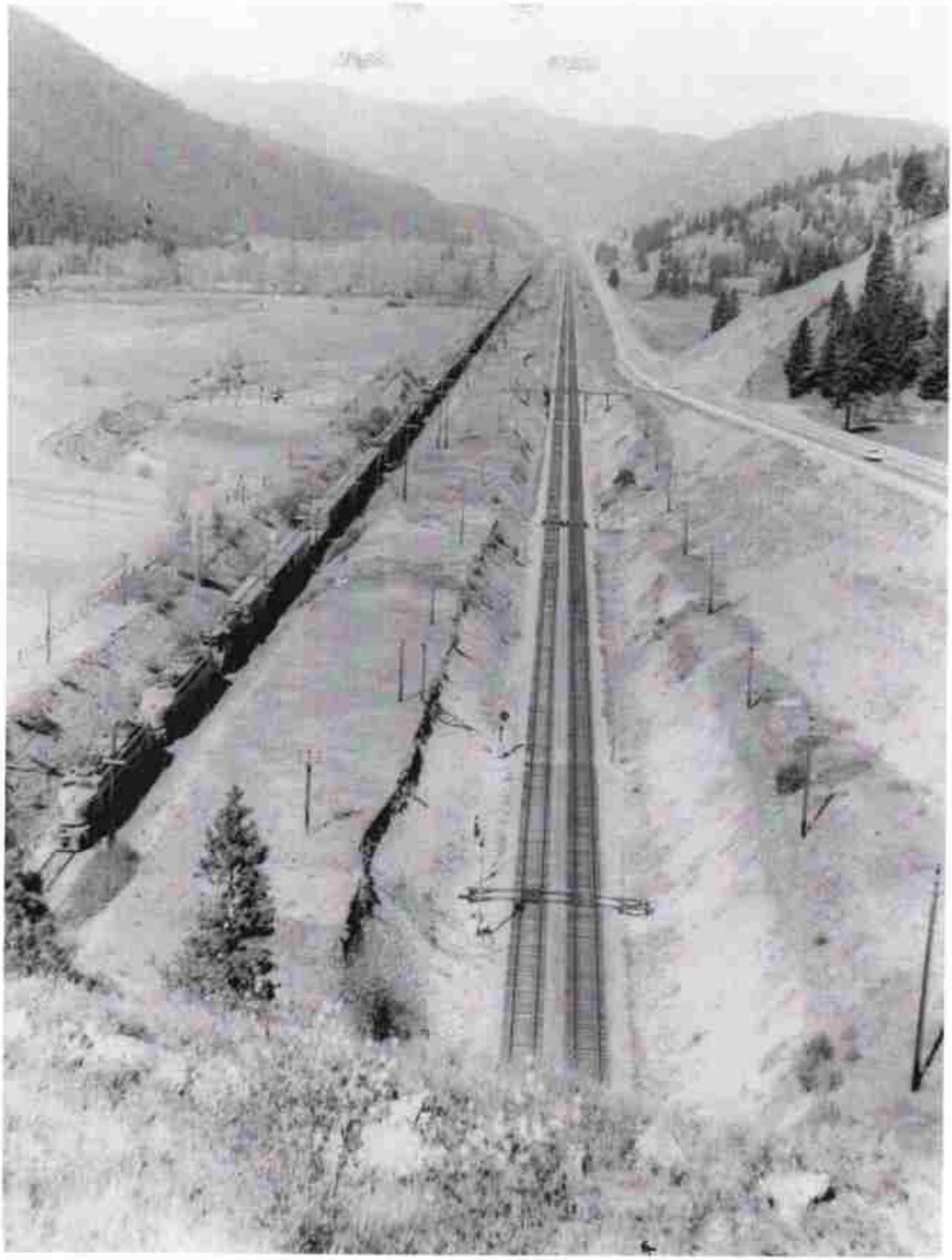
While altitude reduces the diesel power by about 40 percent, the Joes were producing about 40 percent above their rated horsepower. The diesels were still burning the same 180 gallons of fuel per hour to get the 1,800 h.p. that produced 3,000 at sea level. The Joes had an 89 percent efficiency from the trolley line to the driving wheel. The only loss is heat and friction of the gears and the cooling fans. Some difference.

It was hard to bankrupt a railroad with power like that, so they had to go. Their power and efficiency worked against them with this management. Where diesels have to be kept running all the time in cold weather at about ten gallons per hour to keep from freezing the cooling water in the engine, the Joes could be shut down in amy temperature. The standard saying was, "when the cab is warm enough for the engineer, go." There was nothing to freeze, so no terminal operating expense. Just as soon as the pantograph contacted the trolley, you had full power.

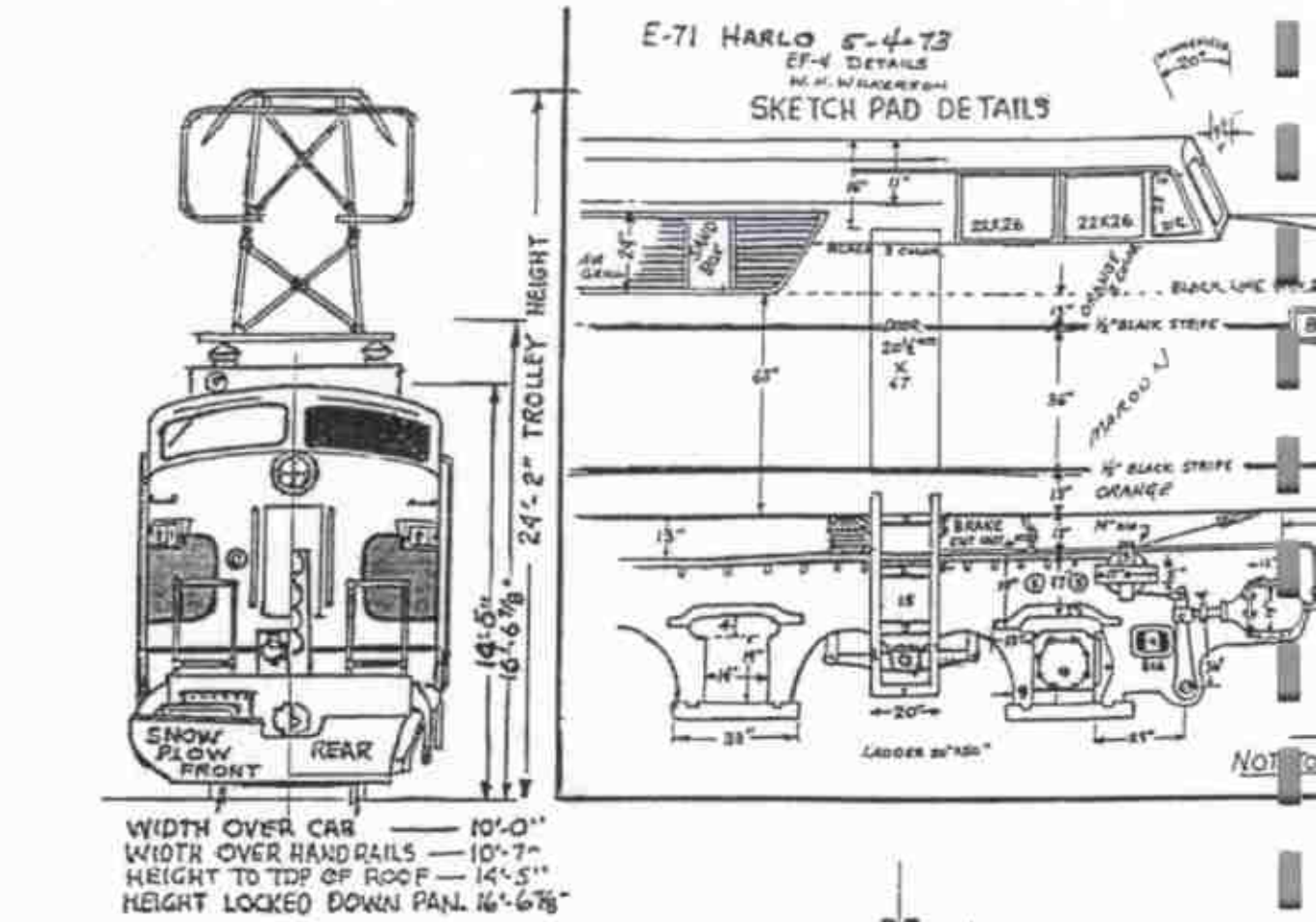
Starting in 1970, the new management began issuing statements about the aging and outmoded electrification. Every statement usually started with a reference to the 1915 installation being outdated and they had to change locomotives in just 440 miles, so they weren't getting enough mileage out of the locomotives, etc. How things have changed. Now with their short 2,900-mile railroad they had just two routes that exceed 440 miles and they claim better utilization of the power. I guess it depends on where the 440 miles are located.

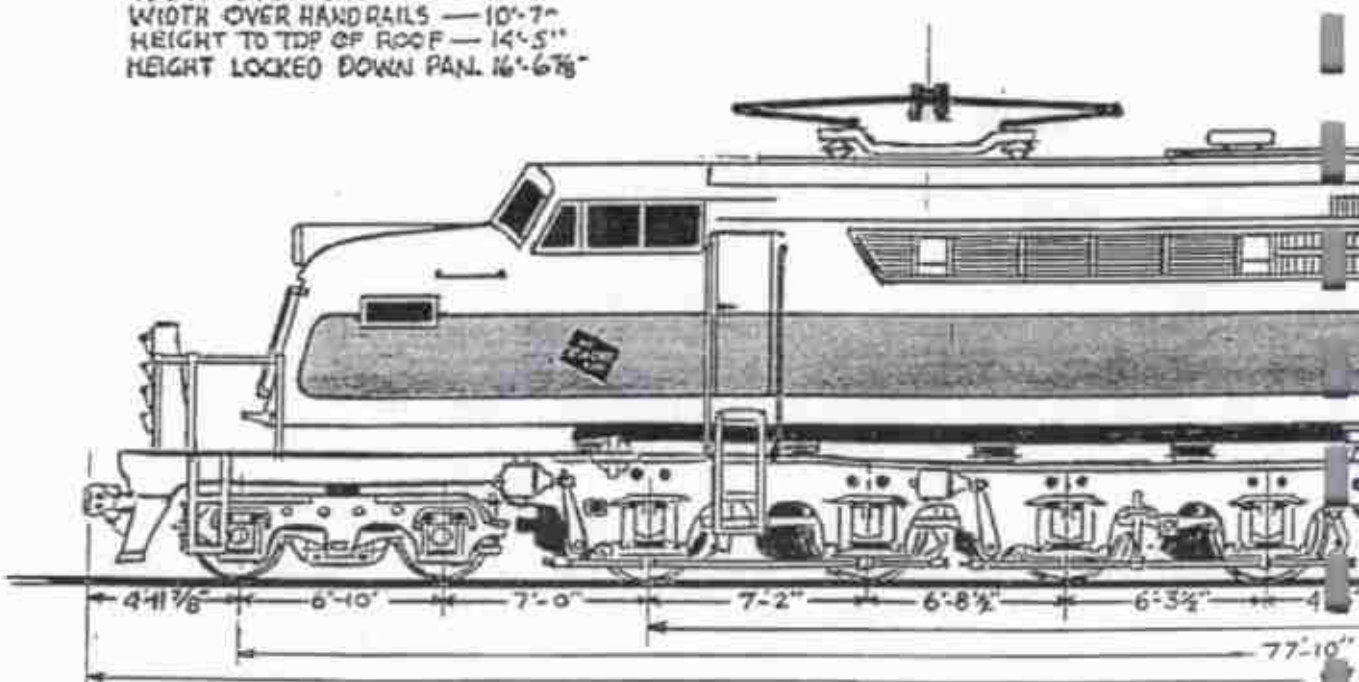
All these statements totally ignored the figures that they had to furnish the Interstate Commerce Commission each year. These figures showed that the electric locomotives were oper-

E-76 was the lead unit on this train. *(Photo by Bill Wilkerson)*



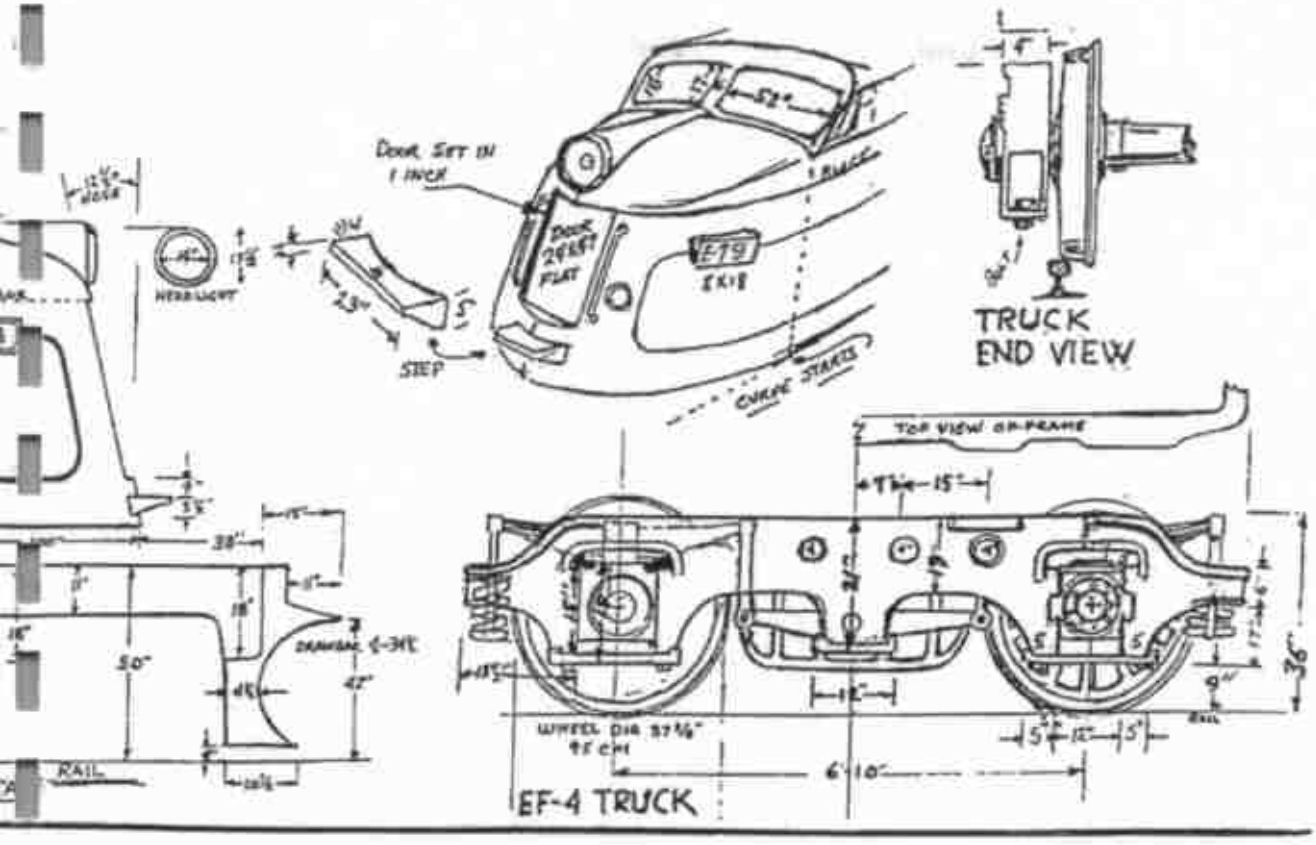
Train 264 at the Bonita Tunnel east of Missoula on May 15, 1959. The Northern P)acific track is to the right and US Highway 10 on the right side of the photo has been replaced by I-90. (R.I V. Nixon photo, Poison, MT)

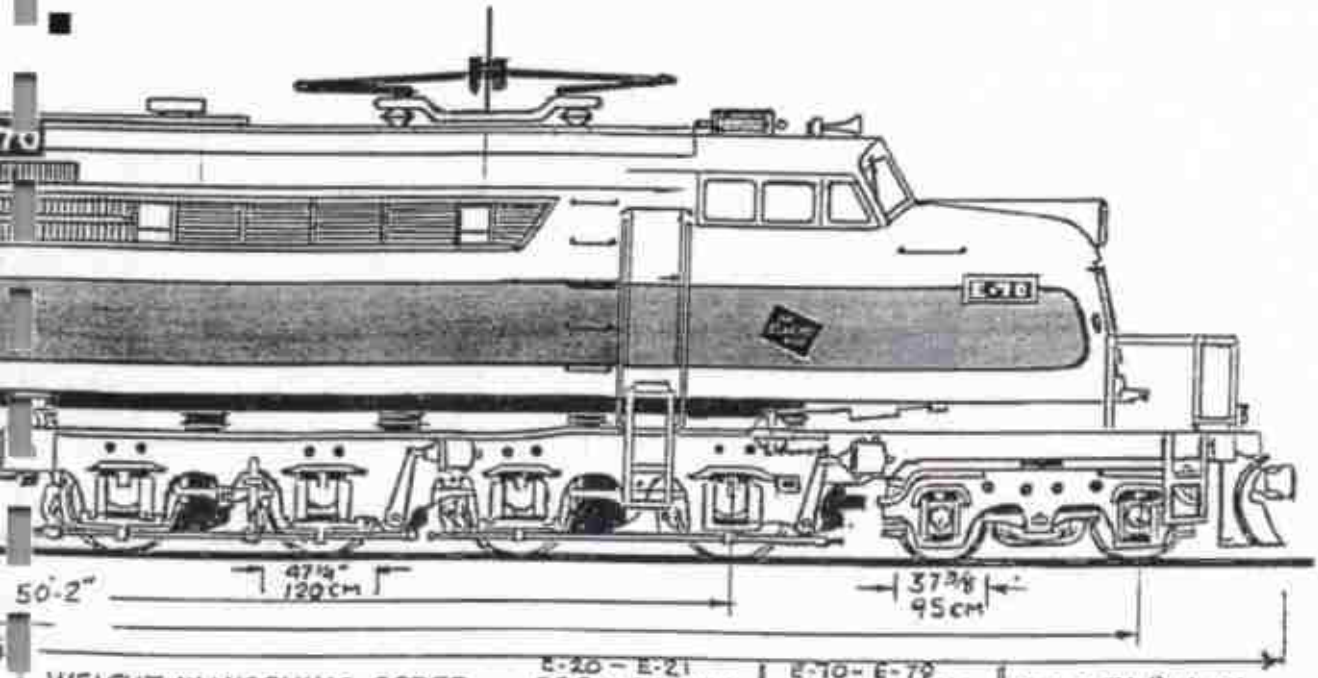




MILWAUKEE ROAD — CLASS - EF-4
NUMBERS E-70 TO E-79 & E20 & E21
TYPE — 2-D-0-2 — (4-8-8-4)
No. OF TRACTION MOTORS — 8

GEAR RATIO — 8
MAX. PERMISSIBLE SPEED — 68 M
HORSEPOWER - CONTINUOUS —
HORSEPOWER - ONE HOUR RATING -





	E-20 – E-21	E-10 – E-19	
WEIGHT IN WORKING ORDER —	552,000 LBS	586,600 LBS.	SCALE 3/16"=1'-0"
WEIGHT ON DRIVERS ———	426,800 LBS	443,100 LBS.	
TRACTIVE EFFORT ———	106,700 LBS	110,750 LBS.	W.R. WILKERSON 9-93

BUILT FOR RUSSIA IN 1948 - ACQUIRED IN 1950 RETIRED IN 1974

ating at 40 to 60 percent that of the diesels and the maintenance cost was 25 to 40 percent. What is more, the electric operation was all in the mountains on steep grades, while the diesel figures were for the entire railroad most of which is relatively flat country. The Milwaukee electrification was a classic example of the saying, "don't bother me with facts, my mind's made up." And it was.

According to several independent studies, one by the Northwest Rail Improvement Committee, it actually cost the Milwaukee $12 million more to replace the electric with diesels than if they had electrified the gap and had 867 miles of electric railroad. This is something other railroads are still dreaming about. This study based its figures on a thirty-year locomotive life, but the box cabs were still pulling strong in their 58th year. They figured by adding more Joes to the fleet to come up to the horsepower actually used with diesel from Harlowton west and with 7-1/2 percent interest and five percent inflation, at the end of thirty years the savings to the Milwaukee figures to a difference of $183,300,000.00. These were all 1973 figures and we know they fell just as short as the projected 14 to 20 cent a gallon fuel.

A tribute to the Milwaukee electrification is that it handled the tremendous increase in World War II traffic without any new power and kept things moving without any undue delays waiting for power. They ran the wheels off the box cabs and even used passenger motors in freight, but they kept the trains moving. How welcome the Joes would have been then!

Ten of the Joes were assigned to freight service between Harlowton and Avery and numbered E-70 to E-79. Two Joes were geared for passenger service on the same division and numbered E-20 and E-21. They had the controls removed from the rear cab to make room for the train heat boiler and fuel and water tanks. They were returned to freight service in 1956 because there was only one passenger train left, and they were needed more in freight service. All the Joes operated up to the end of electrification on June 15, 1974.

There was always a lot of speculation on what would have happened if they had bought the twenty locomotives in 1948 and could have used some on the Coast Division in Washington. We now know it wouldn't have made any difference, because after the Burlington Northern merger in March 1970 and the Milwaukee got all ex-Burlington officials, its' fate as a transcontinental railroad was sealed. They will never convince any of the employees who worked through the last ten years, that the railroad wasn't intentionally bankrupted to get rid of it.

Other railroads are still trying to figure out how to electrify for the savings it returns. The Milwaukee discontinued theirs even after the 1973 oil embargo and while fuel prices were rising daily. We had real good management!

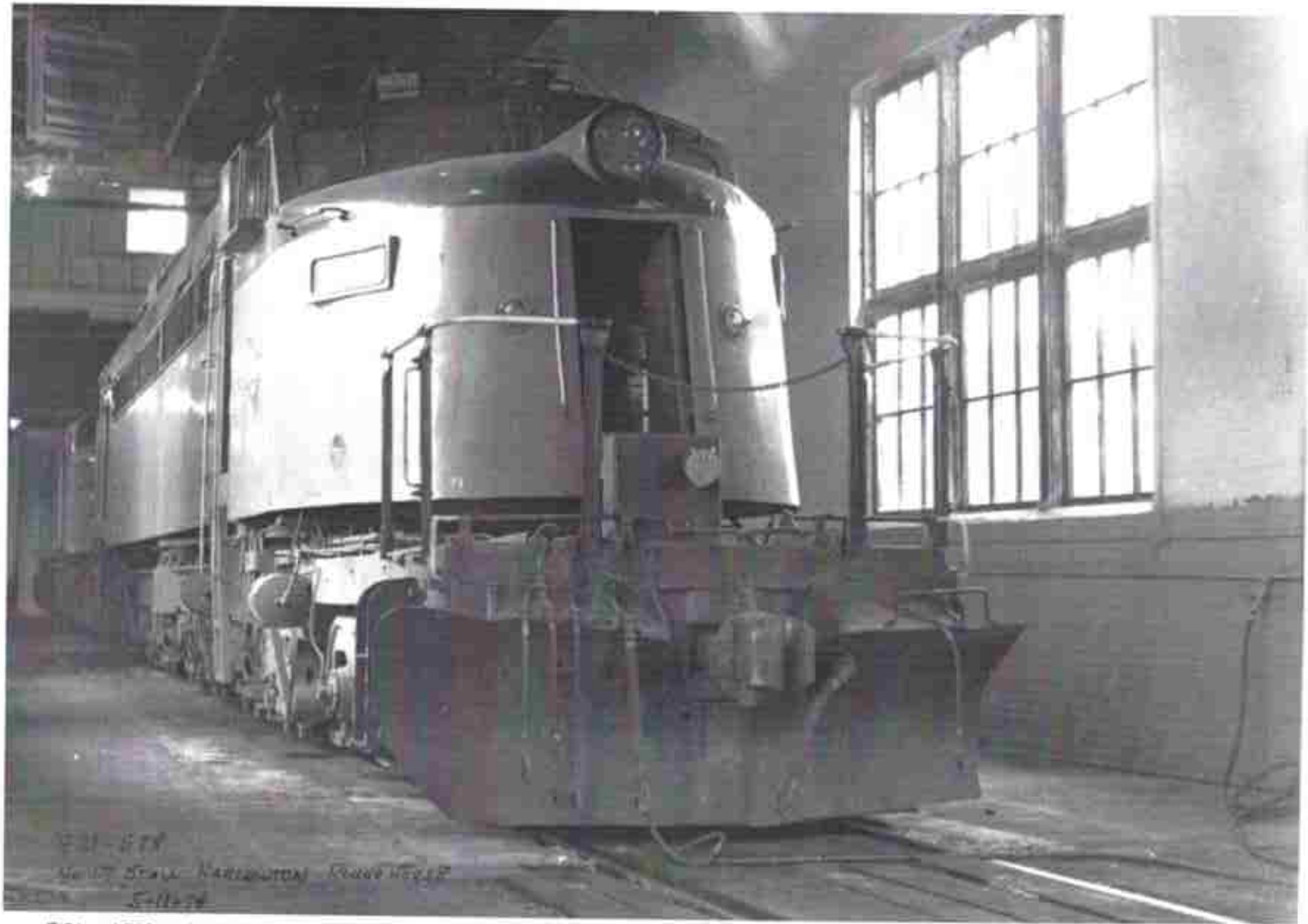
I guess it doesn't make any difference now. The railroad has been torn up according to their plan and I'm retired. Had to — they pulled the railroad out from under me.

The only electric locomotives left in Montana are the Joe E-70 on display at the Deer Lodge courthouse and the E-57B in Harlowton.

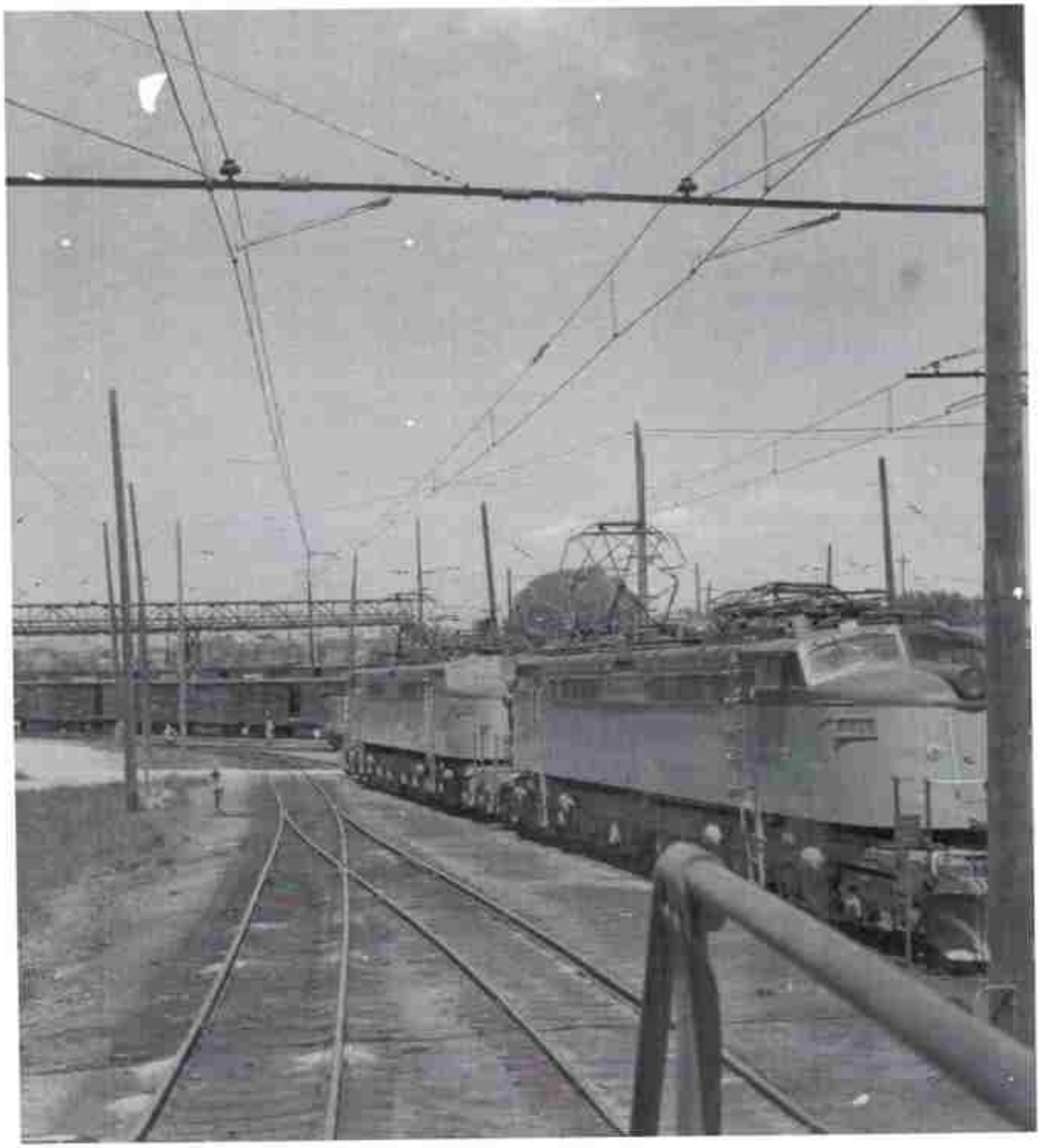
The E2 Bi-Polar electric passenger locomotive is in a St. Louis museum. The E-50 A&B went to a Duluth, Minnesota museum. It was renumbered back to 10200 A&B and returned to its original 1915 look because it was the first one delivered in 1915.

All the rest is just a fading memory now, but it was really a fantastic railroad when everything leaving Harlowton going west was pulled by an electric locomotive.

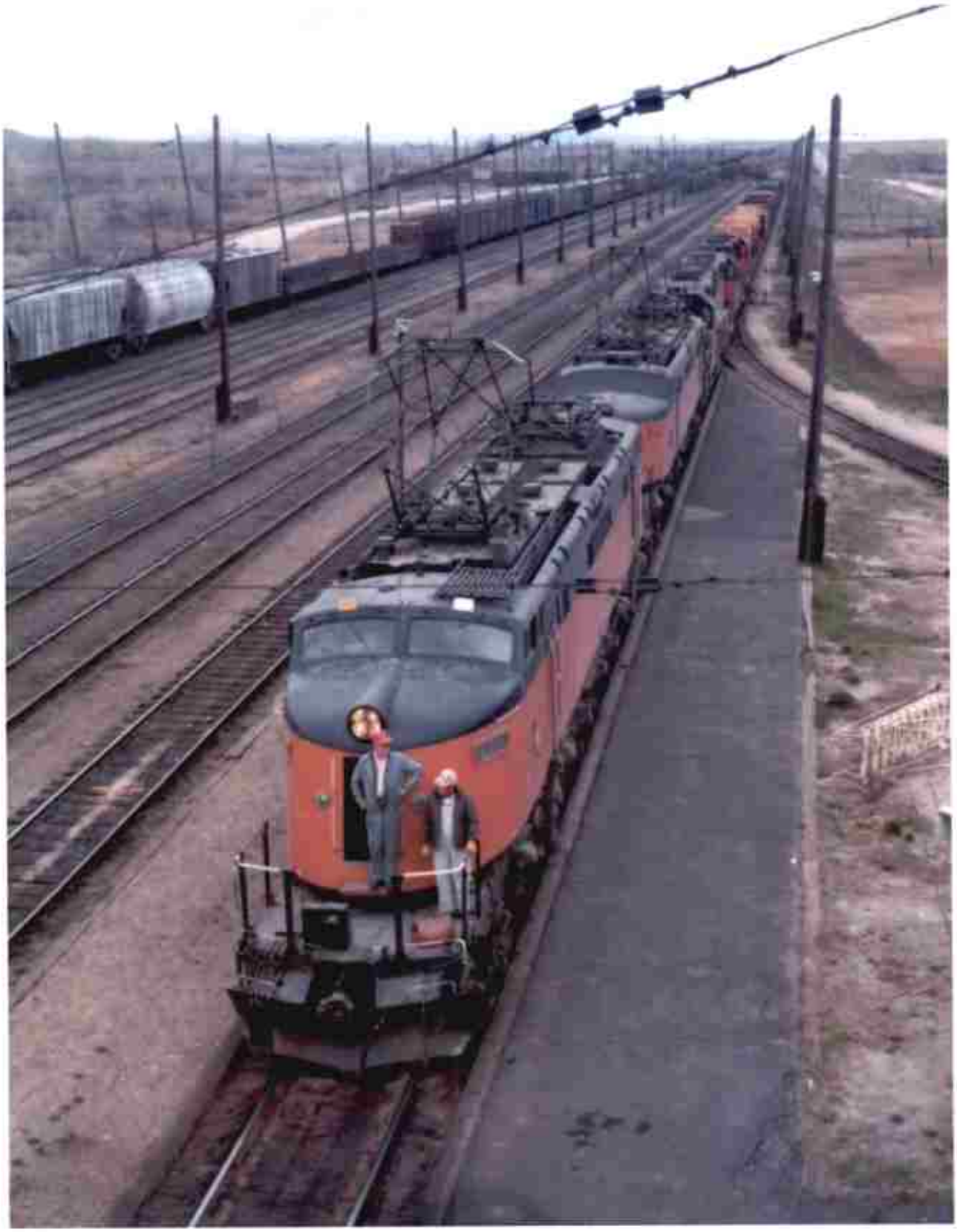
I'm glad I was there!



E-21 and E78 are inside No. 17 stall of the Harlowton roundhouse on May 11, 1974. Note the shop air hose connected to the main reservoir on the E-21 so they would have pressure to raise the pantograph when it was outside and for brakes. *(Photo by Bill Wilkerson)*



Little Joes E-79 and E-74 leave Track 17 at the Harlowton roundhouse for the last time on June 14, 1974. Bill Wilkerson took this photo from the cab of # 3006 as he backed around to the fuel racks. (Bill Wilkerson collection)



Engineer Ed Rexroat and Brakeman Jim Duncan stood on the front of their engine to get their picture taken on one of the last runs for electrical operations on the Milwaukee. The train was coming into the Harlowton yards from the west and Bill Wilkerson stood on the overhead walkway to get the photo. (Bill Wilkerson photo)

Why the E-78 was different!

Hart's wreck in 16 Mile Canyon

Del Hart was a young engineer of limited experience and worked mostly as a fireman from the Three Forks, Montana crew board. Crews worked both east 114 miles to Harlowton and west 112 miles to Deer Lodge. The Engineers Extra board had been eliminated at Three Forks by agreement between the unions and the company on May 25, 1955.

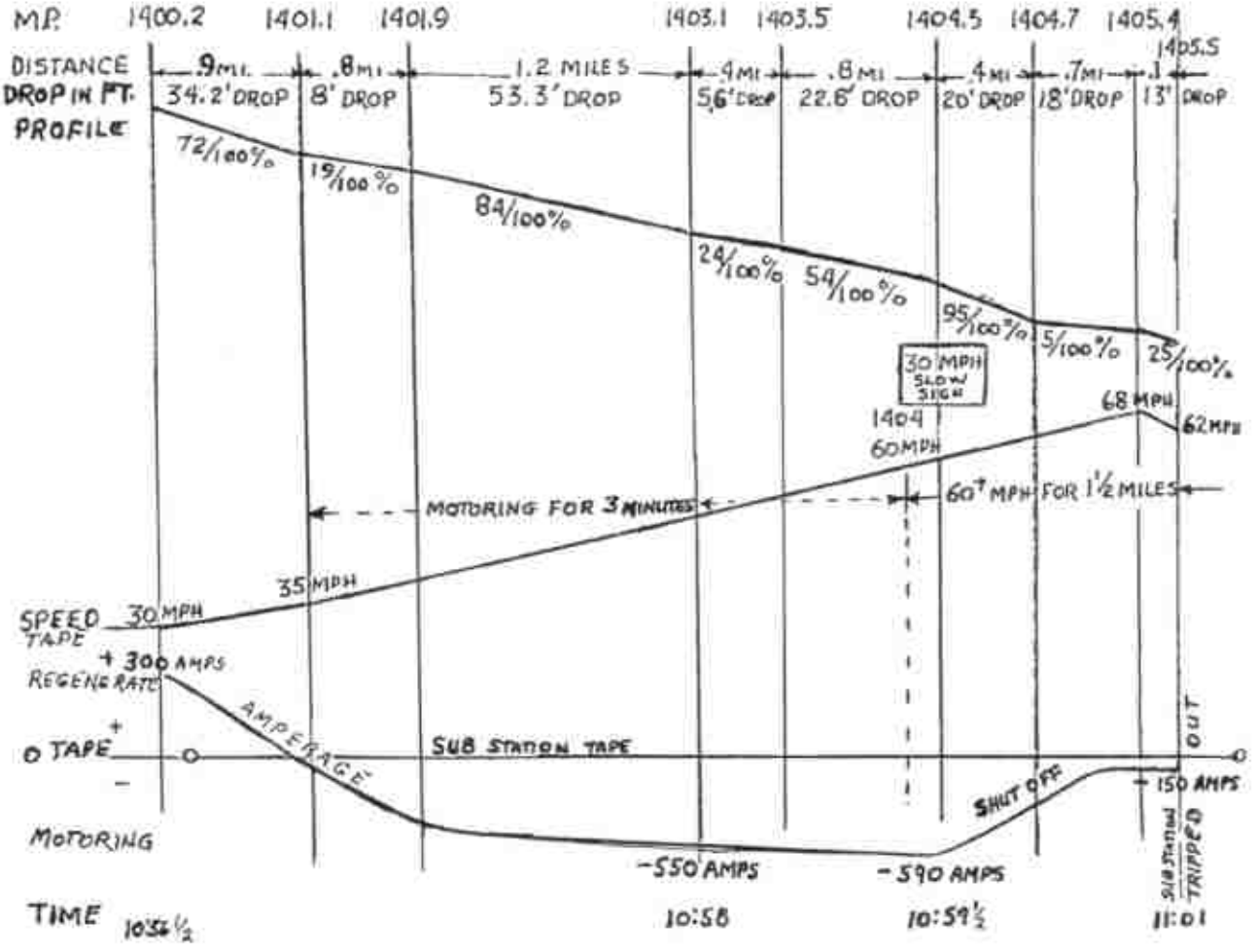
Hart had a 12-13-45 fireman's seniority date but didn't have seniority enough to establish an engineer's date. A provision of the agreement was that all firemen who had passed the tests for promotion would be given their engineer's date according to their fireman's date when the agreement went into effect. The agreement provided that vacancies in the freight pool would be filled by the oldest promoted fireman in town at call time.

Hart had been called as an engineer for the trip from Three Forks to Harlowton without a fireman. He laid over in Harlowton and was rested when he was called for 6 p.m. on May 23, 1966 for his return trip to Three Forks. He had two of the EF-4 (Little Joe) electric locomotives, Nos. E-78 and E-73 and a GP 9 diesel booster (Sputnick) No. 280.

The Joes had arrived in Harlowton with the E-73 as the lead unit, so going west, the E-78 would be the controlling unit. There was only one control cab left on each unit as the controls had been removed from one cab to make room for additional equipment.

A small diesel throttle was built into each Joe operating cab. It was connected to the Joe's throttle and would operate from an offset gear arrangement that brought the diesel into throttle

For easier understanding and quick reference, Bill Wilkerson's chart combined the grade profile, speedometer tape, substation tape, and other information into one graphic that is reproduced here.



The information contained in the the chart proves that Engineer Hart was doing just exactly what he said he was doing, and that was trying to control the train.

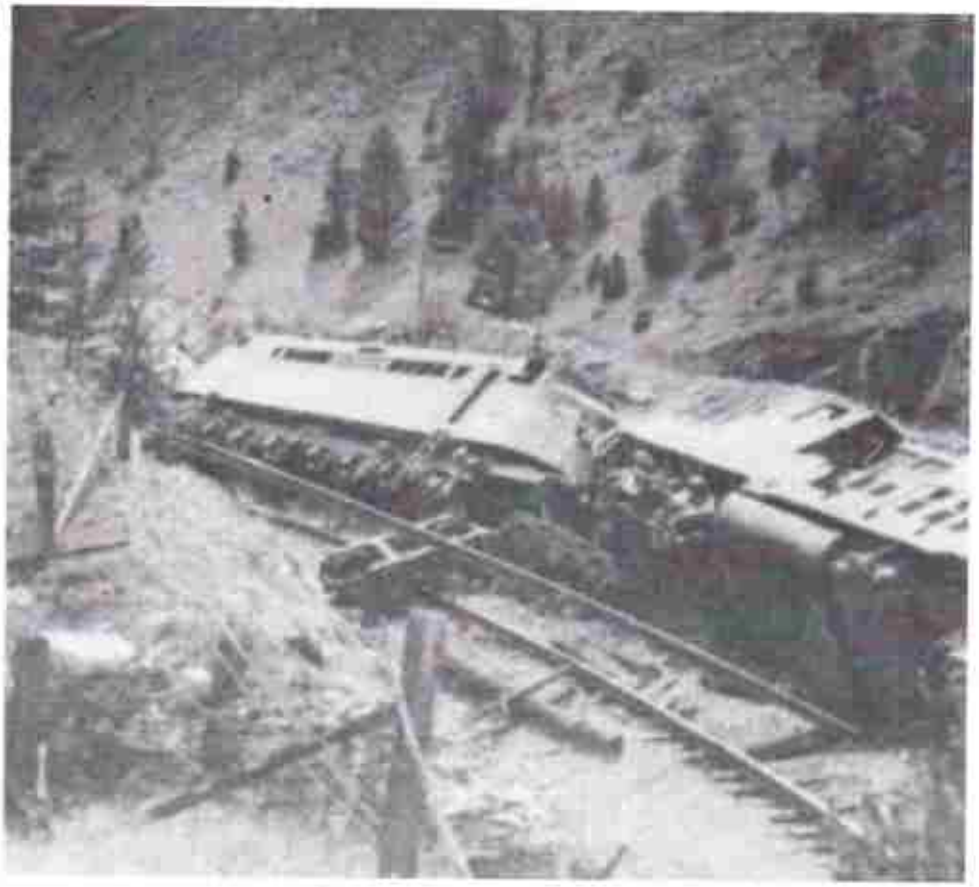
notch 8 (wide open) when the Joes were in 16 (full series). The Joes had 37 notches on their throttle and made transition from Series to Series-Parallel in Notch 17 and from Series Parallel to Parallel in notch 27. Shunting of the fields was also manual on the Joes by moving the regeneration lever forward for the two shunt positions. The GP-9 had automatic transition and shunting that was activated by voltage rise going up and amperage increase to shift down. The diesel was used to compensate for the voltage loss on the trolley line in the sag between the substations. Most substations were 30 miles apart. This resulted in varying voltage drop according to the distance away from the sub station and the current the motors were drawing off the trolley. The diesel throttle could be disengaged by pulling up on a locking pin so the throttle knob could be turned back to any notch if the diesel got to slipping.

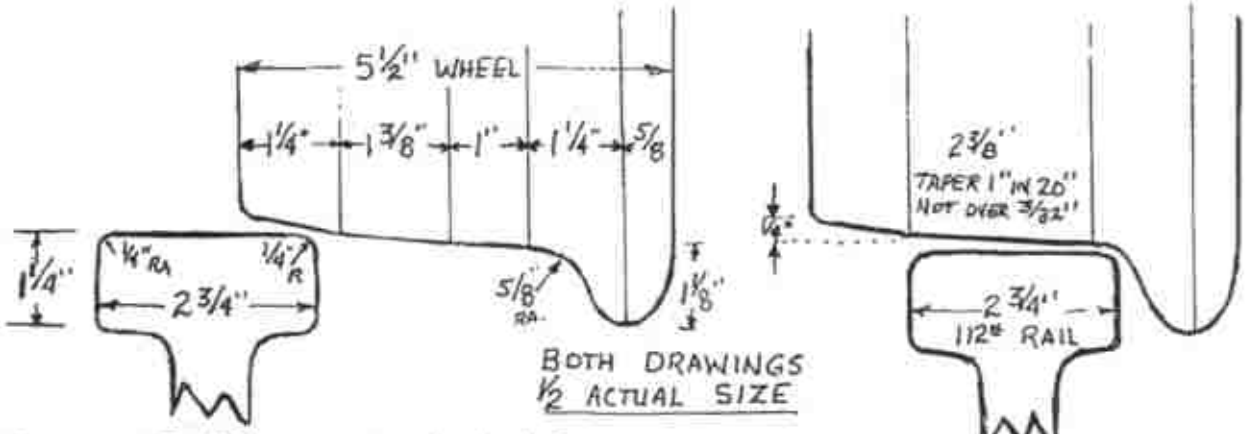
Hart's train that night consisted of 35 loads, mostly wheat, and 64 empties for a total of 4,500 tons. He departed from Harlowton Mile Post 1336 at 8:20 p. m. About MP 1387, west of Hamen, going down hill, the train parted and made an emergency application of the air brakes and stopped. They coupled the train up again and when the brakes released, he proceeded west.

It is all down hill for 43 miles from Hamen to the Missouri River at Lombard at MP 1430.

The E-78 and all EF-4's had two speedometers in the operating cabs. A General Electric speedometer was in the dash and a Chicago Pneumatic cable-drive equipped with a recording tape was an add-on and located to the engineer's left in front of the fireman's seat. Neither speedometer was working and hadn't worked for several trips. The E-73 C. P. speedometer worked and had a recording tape, but that was 160 feet behind him on the opposite side. The Joes should have turned on the WYE at Harlowton so the E-73 would be the operating cab with the speedometer.

Hart had a slow order of 30 MPH around three sharp curves between MP 1398 and 1400. The E-73 tape showed that he slowed right down to 30 MPH for the curves. From 1400 to 1404.3 the speed limit was 60 MPH and then in 3,000 feet it dropped to 30 MPH for a left hand curve and right into a 25 MPH left hand curve. This was a trap if there ever was one. By the time he pulled his 99 cars around the 30 MPH curves at 1400, he would be to 1401. By the time he got his train up to 60 MPH, he could only run at that speed for a mile at the most before he had to slow down again. This was all on a downgrade with grades up to 1% (52.8 ft. per mile). Most of the older, more experienced engineers didn't try to get up to 60 MPH for such a short distance, as it wouldn't gain them more than a minute or two at the most, but Hart did get up to 60 MPH. He set his air at the proper place going through the station of Sixteen. The men in the caboose testified that they could see sparks from

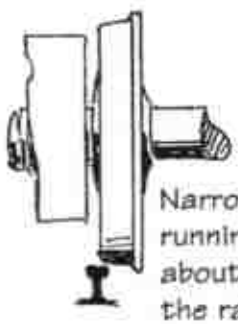




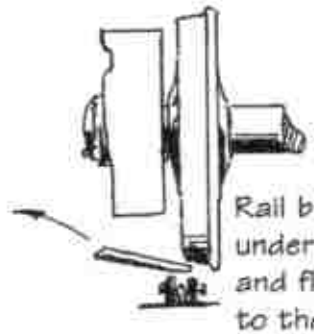
Position of 2-1/2" narrow tread wheel of E-78 on the rail was running on the outside taper.

Normal wheel on the rail.

Narrow Tread Wheel



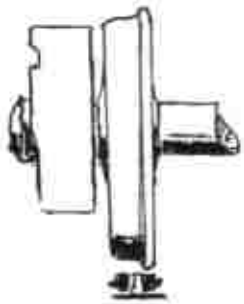
Narrow tread running with about 3/4" on the rail.



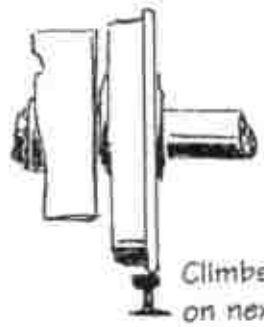
Rail breaks under wheel and flies out to the south.

Narrow tread climbs up on next rail and continues on.

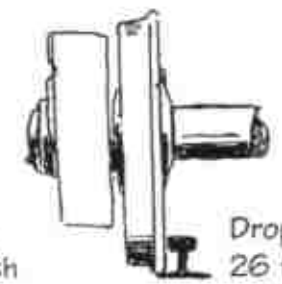
2nd Wheel Is Normal Tread



Normal tread drops down onto angle bar of broken rail.



Climbs back up on next rail with flange running on top of the rail.



Drops off rail in 26 ft. and pulls to the inside of the curve.

This series of drawings by Bill Wilkerson shows how a broken rail caused the rear truck of the E-78 to derail and overturn the E-78.

the brake shoes all along the train and the brake set up on the caboose and they began to slow down.

The E-78 train line pressure was set at 90 pounds for mountain operation. The 280 was set at 80 pounds which was the standard operating pressure for trains east of Harlowton. The 280 feed valve was either still cut in at Harlowton and Hart didn't check to make sure it was cut out, or the 26 L brake valve malfunctioned as we claimed. Either way, he could only make a 10 pound reduction on the train line. When he tried to draw off more air below the 80 pounds the 280 was set at, it would cut in and start maintaining the train line at 80 pounds.

Hart testified that he had a continuous strong exhaust in the cab. This would indicate the 280 was maintaining the train line at 80 pounds. He was aware of the strong continuous exhaust at MP 1398, but the 10 pounds had been enough to slow him down to 30 MPH. A more experienced engineer would have recognized that he had trouble with the air when the exhaust in the cab kept blowing strong and wouldn't seat. That is the reson the exhaust is in the cab, so the engineer can tell by the length and strength of the train line exhaust how much of a set he is getting on the train. When he got the same continuous strong exhaust at MP 1400, he should have gone right into emergency. This would have overcome the 280 supply and stopped the train as it did at Hamen.

According to a chart the company supposedly made from the E-73's speed tape, he slowed down from 68 MPH to 62 MPH when the three locomotives turned over on their right sides in a rock cut in the 25 MPH curve at MP 1405.5.

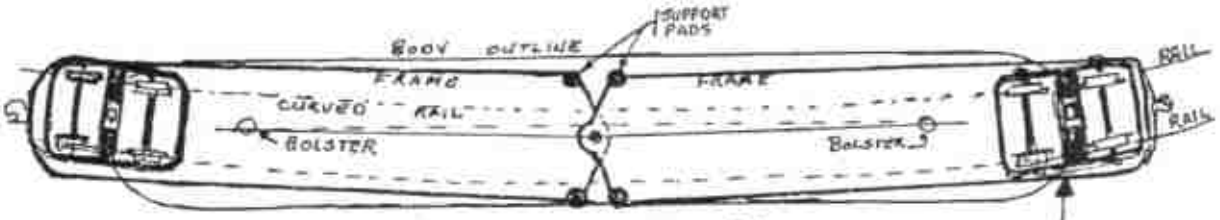
It also derailed sixteen loads and eight empties behind the locomotives. They were mostly stacked crossways off the curve on the north side and down into Sixteen Mile Creek. There were four loads and 23 empties derailed ahead of the caboose. The 49 cars in between stayed on the track.

Engineer Hart was pinned in the crushed cab for several hours until the wrecking crew could cut him out.

Hart and Brakeman Jim Satake were both badly bruised, but didn't suffer any broken bones or serious internal injuries.

When a wreck causes that much damage, the company wants scalps. The very nature of railroading gives the company the advantage. Their officials are the first on the scene to make the initial examination and compile the so-called Official Record. This had better be in the company's favor, or we'll have new officials — it was that simple. Of course, nothing is ever wrong with the equipment or their operating methods.

Top View

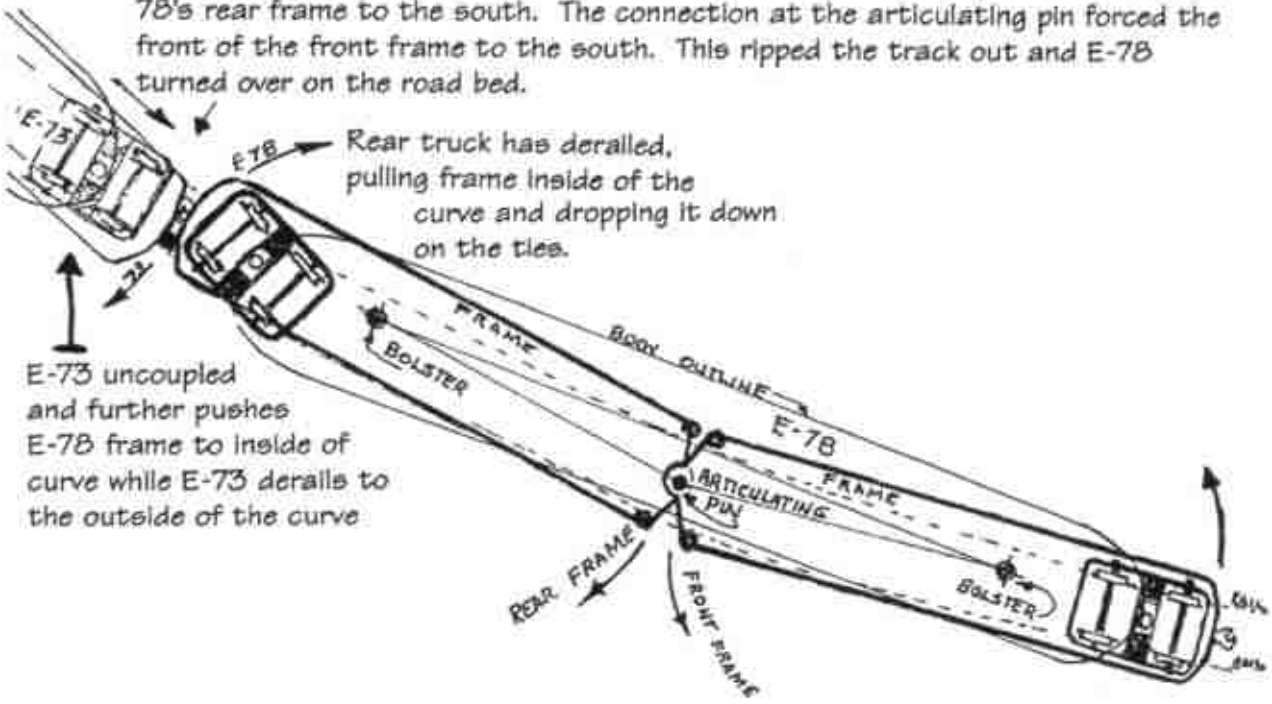


Rear truck has moved over and turned the same as the front truck.

Approximate position of frames and trucks on a maximum curve or 16 degrees.

Truck has turned and moved sideways to guide frame around the curve.

E-73 uncouples and slams into E-78's frame north of the coupler. This forced E-78's rear frame to the south. The connection at the articulating pin forced the front of the front frame to the south. This ripped the track out and E-78 turned over on the road bed.



E-73 uncoupled and further pushes E-78 frame to inside of curve while E-73 derails to the outside of the curve

Top View

Frame is forcing extreme side pressure on front truck and south rail, causing rail to push out from under the locomotive.

Showing forces being exerted on trucks and frames of the E-78 during initial derailment of the rear truck

23 (A)

They try to make sure it is always "man failure." In this case it was Engineer Hart's failure to control the speed of his train around a restricted speed curve on a descending grade.

This investigation was held in Three Forks on June 21, 1966 and lasted 13 hours and 35 minutes. Both Engineer Hart and Brakeman Jim Satake were still recovering from their injuries and were forced to sit through the full investigation and endure hours of cross examination. The company did furnish them upholstered chairs after lunch because the Unions had protested about the inhuman teatment of the two injured men.

There was no denying that the E-78 entered the 25 MPH curve considerably above that speed. The company wouldn't produce the speed tape from the E-73 if one existed. They were 1,000 mile tapes, so changing them wasn't a high priority at either Harlowton or Avery. They had drawn a large chart that was claimed to be drawn off the E-73 from MP 1392 to 1405.5 where they derailed. The Unions protested the company not producing an authenticated speed tape. The company claimed it was so faint it was hard to read, is why they had drawn the chart instead. The truth more likely was so they could show excessive speed and place the blame on Engineer Hart, and there probably wasn't a tape in the E-73's speedometer or it had run out.

The Francis substation tape was introduced as evidence. It showed that Hart had shut off at 10:59 p. m. and from then on he was drawing 150 amps. This is the current it takes to run the Motor Generator sets and the compressors and other electrical equipment on the two locomotives. The tape proved that Hart was doing exactly what he said he was doing. The substation kicked out at 11:01 p. m. when the wreck tore the trolley line down.

Other craft employees got word to us that there was a broken rail 15 feet into the curve on the south side (inside). Twenty inches of rail broke at an angle bar and was found about 10 feet away on the south bank.

Some shop men got word to us that the trailing truck on the E-78 had the front pair of wheels running with a 2-1/2 inch narrow tread. They had to use the truck off the E-73 on the E-78 when it was shipped to Milwaukee, Wisconsin for repairs.

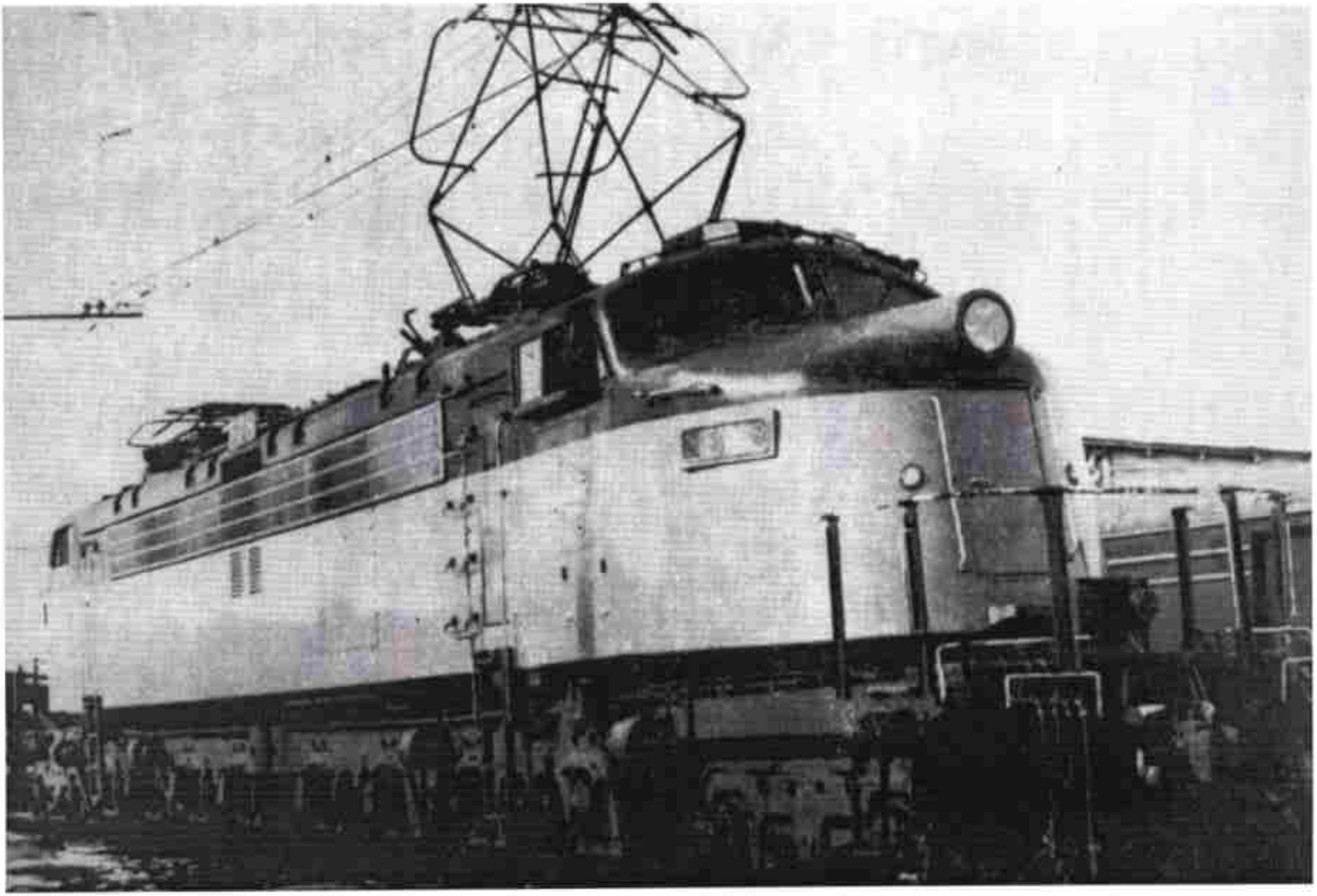
The Master Mechanic admitted the narrow tread, but insisted that it was pressure on the wheel during the wreck that forced the wheel in 2 1/2 inches on the axle. Here was the cover-up of the century. Wheels are pressed on the axle in a large wheel press. They have to be perfectly square with the axle or they will break. The wheel hub is cut undersize 8/1000 of an inch to stretch over the 8 inch axle to insure a tight fit. If it slides on with 110 tons of pressure, it is too loose. If it slides on with 120 tons, it is too tight or binding and they have to back off and check to make sure the wheel couldn't slide in on an axle from pressure being exerted on the tire 18 inches out from the center. It would break the spoke wheel before it would move on the axle.

For a simple proof of this, look at the little bent washer on your storm or screen door closer cylinder. The washer will slide easily along the piston rod as long as it is perpendicular to the rod. At the slightest angle, it binds and holds the door open even under pressure from the wind. The hole in the washer is large enough to slide along the rod easily and holds by gouging action. You can see that a wheel that is cut undersize to the daimeter of the axle and then stretched over it by 120 tons of pressure, certainly wouldn't move by pressure exerted 18 inches from the center.

GP-9 No. 280 was equipped with a 26 L brake valve. At that time, we were experiencing a lot of trouble with the 26 L brake valve in trailing units cutting in even with the cutout cock in cutout position. Even picking up the wreck, Engineer Murphy had trouble with the 26 L brake on the 308 and 320 consist. The brake on the 320 cut in while he was pulling a cut of cars and he couldn't set the brakes from the 308. Two days later, he experienced the same trouble with the 309 and the 327 consist. On both occasions, an official was in the cab with him and in the investigation they had to admit the problem existed. These were the same GP-9 class as the 280 and equipped with the same 26 L brake valve.

There was no way the company could make a brake test of the locomotives that Hart was operating. They were badly damaged with brake cylinders and pipes knocked off. The E-78 and the 280 were sent to Milwaukee for repairs and the E-73 was repaired at Deer Lodge.

Milwaukee welded two diesel F7 cabs on the E-78 and had to reuild the entire right



No. E-78 is pictured at the Harlowton Roundhouse in February 1974. This was the one of the engines involved in Hart's wreck in Sixteen Mile Canyon on May 23, 1966. It was rebuilt in 1966 with F-7 E.M.D. cabs and air grills. (Wilkerson photo)

side. I never could see why they welded two operating cabs on the E-78. The Joes had been operating for several years with one cab blocked off to house additional equipment. The second cab on the E-78 was blocked off when it returned from Milwaukee, so why waste the money on another cab section? They could have welded an F7 B end on and had more room for the added equipment for less money. They even welded metal plates over the window openings of the rear cab.

Hart testified that it felt like the E-78 derailed from the back as it lurched back there before it turned over and he was knocked out.

Connecting up the evidence we had showed the leading axle on the E-78 rear truck had wheels mounted 2-1/2 inches too narrow. This kept about an inch of the wheel running on the rail. When the narrow tread wheel hit the broken rail in the angle bar, the tremendous pressure in the side of the rail from the tapered wheel tread, threw the piece out to the south bank. The wheel dropped onto the angle bar, but jumped up on the rail again and continued running on the one inch taper. The second wheel dropped down onto the angle bar and jumped up on the rail. The tapered tread of the first wheel caused a twisting of the truck that was enough to turn the wheel just enough so the flange came down on the face of the rail. The flange cut on the rail showed the flange had run down the rail 26 feet before it derailed to the south of the rail. The pressure of the rear truck pulling to the south caused the articulated frame to buckle to the north at the joint between the two frames. This in turn forced the front of the front frame to swing to the south. The south rail tore loose under the side pressure and derailed the E-78. This was proved because the E-78 was lying on its' right side, right in the middle of the roadbed and both rails were shoved up against the south bank. The E-78's rear cab was smashed in on the north side. The E-73 jackknifed to the north plowing into the E-78 and the E-73's cab was badly smashed on the south side by the E-78's rear frame when the E-73 started to dive under the E-78. The E-78's front truck was caught under the north rail, right below the cab of the 280 which had been running short cab forward.

Had it just been excessive speed as the company claimed, the E-78 would have just tipped sideways and laid up against the north bank of the rock cut. The north rail would probably have torn loose, but probably not the south rail as the tipping over action would have taken the weight off the wheels on the south rail. The fact that a trolley line pole was still standing undamaged in the cut off the north rail would prove that it wasn't excessive speed that turned the locomotives over. The trolley poles that were broken were broken by the E-73 and 280 as they jackknifed to the north.

The company couldn't show the true cause as being the 2-1/2 inch narrow improperly set wheel that was allowed to leave the shop and operated on the railroad as they would have been subject to a heavy fine by the Interstae Commerce Commission, so they had to make it look like excessive speed due to man failure.

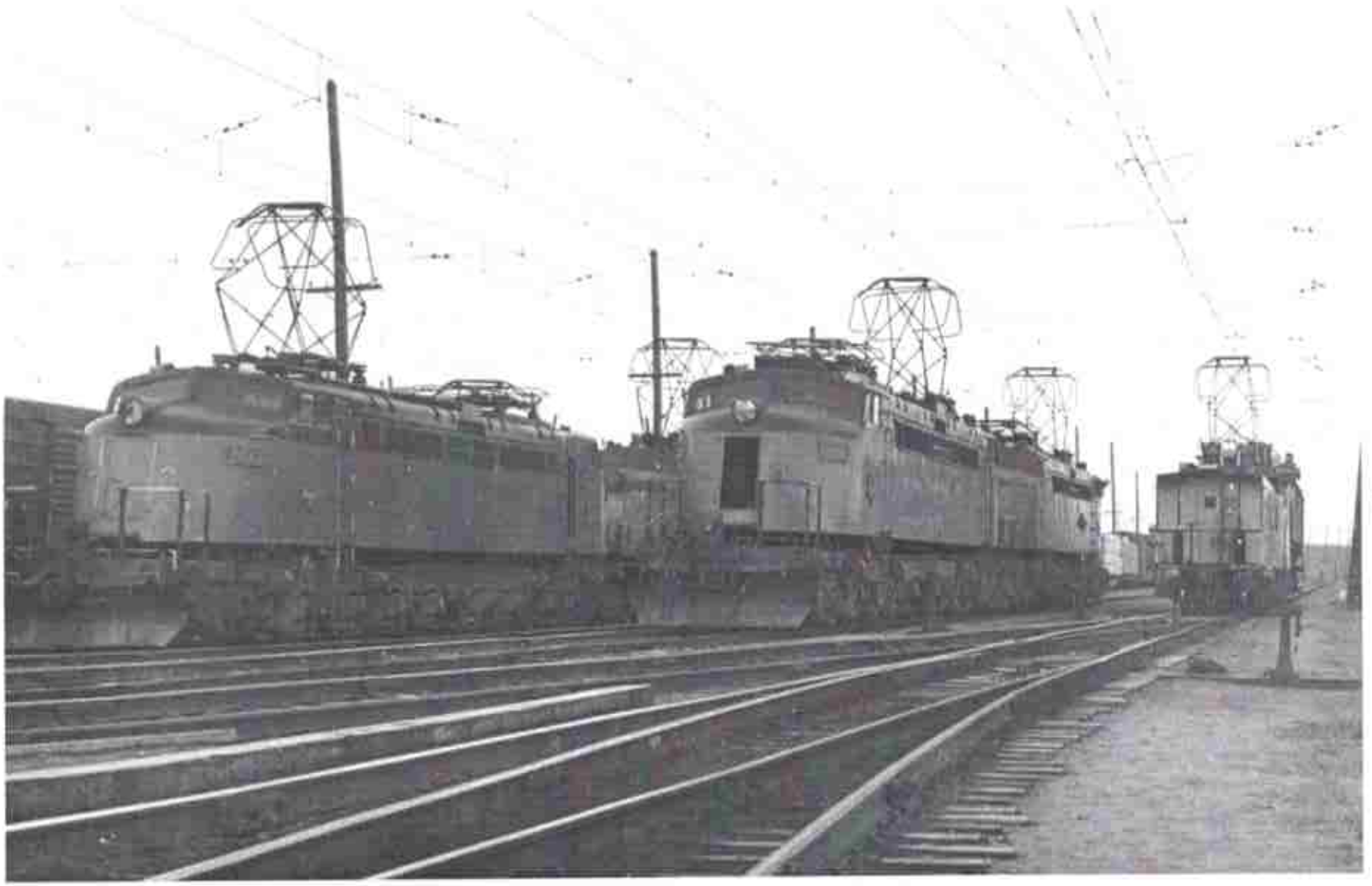
The entire crew was discharged on July 25, 1966. The trainmen were all reinstated in 90 days, but General Manager Vince Anderson refused to reinstate Hart at that time

As General Chairman for the Brotherhood of Locomotive Firemen and Enginemen representing Hart, I had no choice but to request a Special Board of Adjustment be set up under the Railway Labor Board to judge the case.

I prepared my case with all the information contained in the investigation transcript and drew charts and other illustrations to try and prove my case.

As required by the law, we exchanged copies of our submissions and met for a conference to see if we could reach a settlement before the Board took the case. Anderson was a fair man. He knew the Milwaukee and he knew railroading. We had worked with and against each other for six years and respected each other. He complimented me on the details I had figured out and put in my submission. He told me I had gone to an awful lot of work on my case, but the fact remained that it was Hart's poor judgment that caused the wreck. He said that Hart hit that curve too dam fast and we both knew it. I told him a lot of my case was based on why Hart hit the curve at that speed and it appeared to be defective brake equipment on the 280 and other mechanical defects on the locomotives.

Anderson told me he had been in the cab with me and other engineers when we set the air and we knew within seconds how much of a set we had by listening to our exhaust and the



FIVE PANTOGRAPHS IN THE AIR! Bill Wilkerson took this photo in the Harlowton Yards on April 1, 1974. (Left) Arriving on Track No. 2 are E-79 and E-76 with Engineer C. P. Richardson; (Center) is E-71 and E-70 with Engineer Al Patric; (Right) is E-57B and E-34C switching with Engineer Dick Pemberton E-79 and E-76 came in with dead freight on No. 2 track while E-71 and E-70 were on No. 1 track waiting for the E-57B and E-34c to finish working Train # 261.
(Bill Wilkerson collection.

Moving the E-70

October 18-20, 1993

By Ed Lynch

Residents of Powell County wanted to move the E-70 to a spot more noticeable to the tourists who traveled through Deer Lodge. Funding was secured from a grant provided by the U. S. Forest Service, and a contractor was secured. The move was made by a house-moving contractor from Helena.

The "Joe" was first jacked up and a frame built around it. Next, house moving dollies were placed under the frames and the whole thing was cable to the Joe's frame. All this preparation work took almost two months to complete and was very painstaking. The actual move took place October 18, 19 and 20, 1993. The contractor had a lot of problems as the E-70 was within seven feet of a building and had to be pulled out at an angle. At first they tried to move the Joe with two

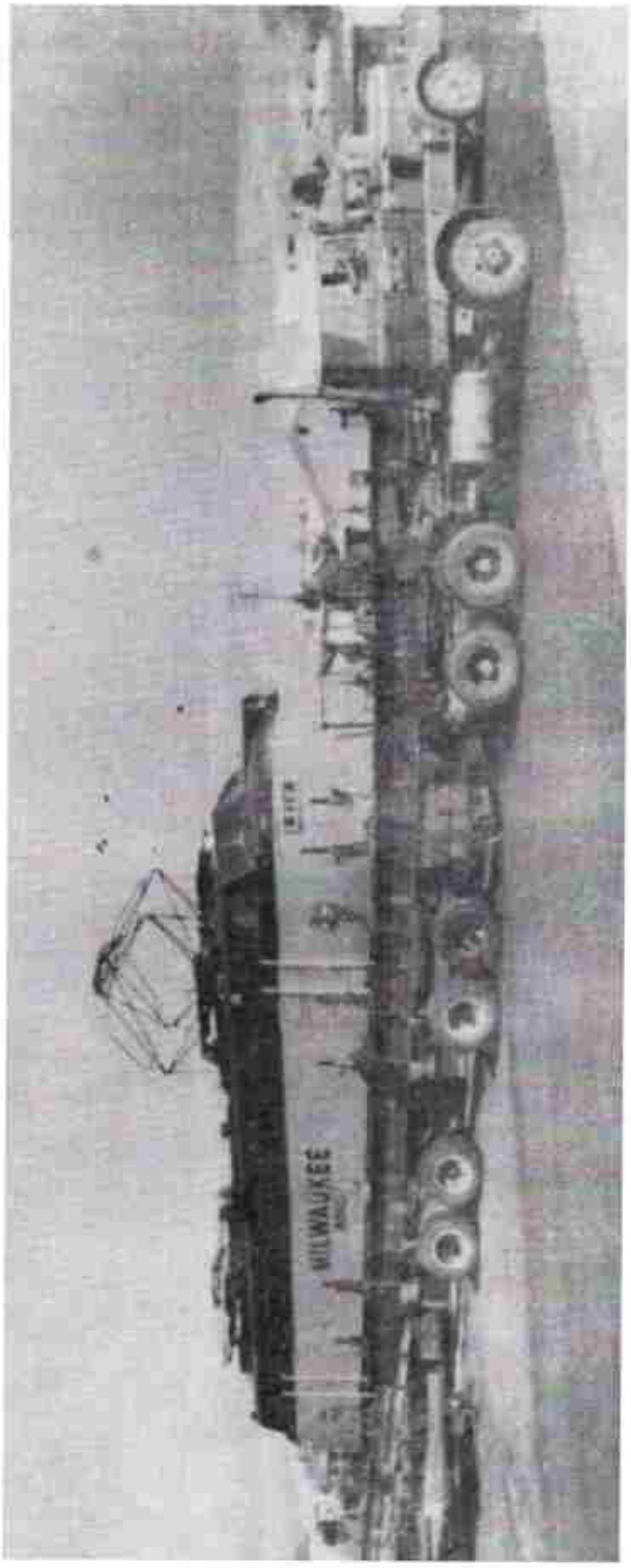
This photo taken by Ed Lynch on October 19, 1993, shows how the E-70 was carried in a cradle between two trucks and trailers.

semi-trucks, but the E-70 would not move. Next, they tried hooking up two front-end loaders with the trucks and that did the trick. On the first day, the E-70 only made it to the corner on Missouri Street.

On the second day, the E-70 was moved ten blocks in 45 minutes, going to Conley Street where it would make a left-hand turn. It took the contractor over eight hours to make the turn, and the Joe remained overnight on Conley Street.

On the third day, the E-70 was backed down Conley Street, across Main Street, to a new home in the parking lot of the old Montana Territorial Prison. This location was thought to have the best public exposure and provides better photo possibilities.

Restoration of the E-70 will begin in the Spring of 1994 with completion expected in June or July.



This photo of the E-70 move in Deer Lodge was taken by Ed Lynch on October 19, 1993.

Events of Project E-70

as of October 24, 1993

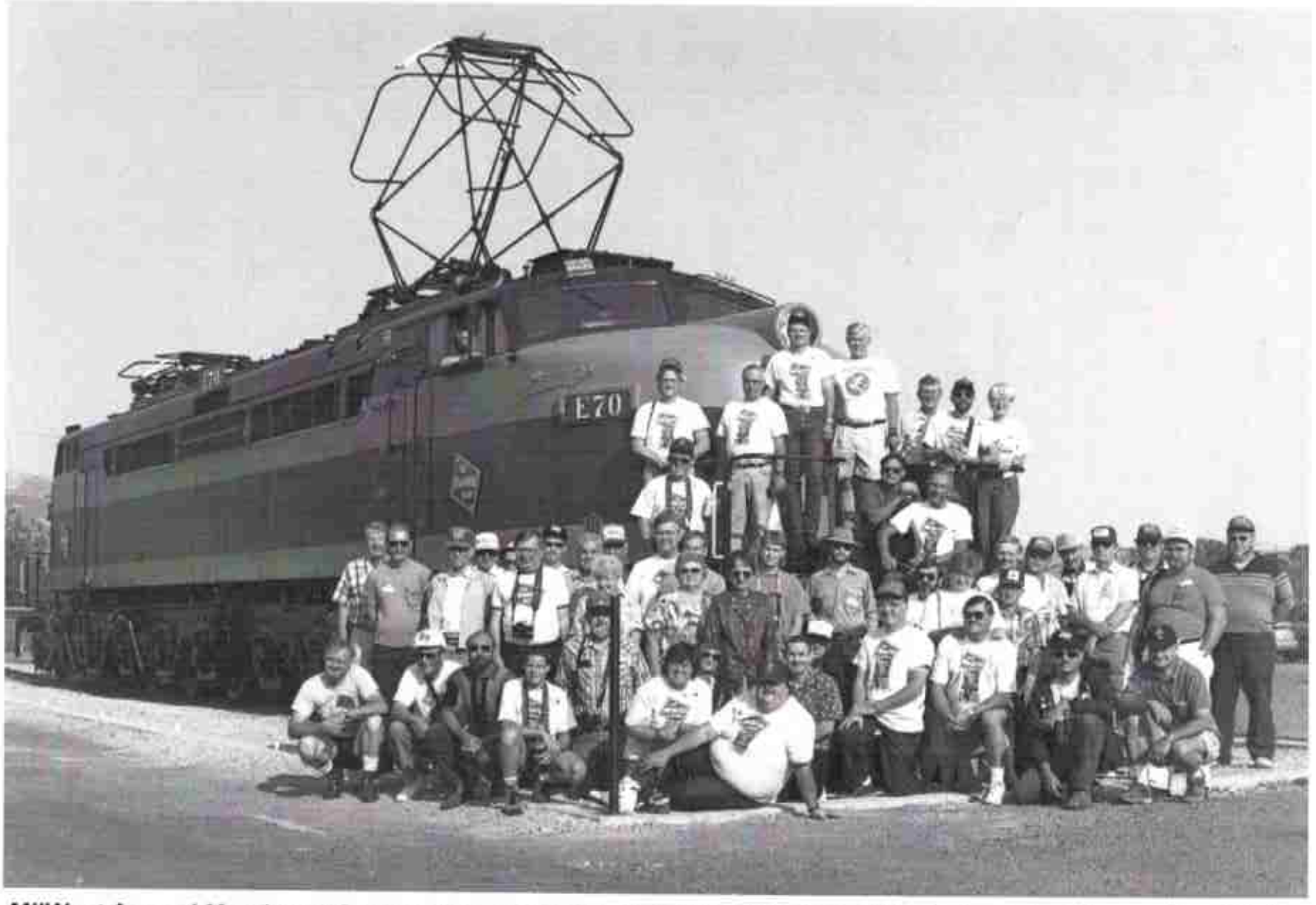
Project E-70 started out as an idea of several ex-employees in Deer Lodge in 1984. At that time the project did not get much attention and only about $300 was raised.

"MILWEST" entered the project in 1992. At their annual meeting in Miles City, Montana, the membership voted to initiate plans to restore the E-70 to its' 1950's appearance. General Manager Ed Lynch and Assistant Arthur Jacobsen held several meetings with Dick Labbe, Mayor of Deer Lodge, and Powell County Museum & Arts Foundation. After these meetings it was decided that the project was a go, and a bank account was opened at Deer Lodge Valley Bank with $10.00 in September 1992.

After this, notices were sent to all major railfan magazines advising people that donations were needed. Also, DuPont Paint company was contacted about donating the paint, and they agreed to do so. Soon after, donations started pouring in from all over, including $11,000 from Casey O'Neil of Lake City, Minnesota.

In February 1993, General Manager Ed Lynch made contact with an Artist & T-Shirt Company in New Mexico. It was decided that a T-shirt of the E-70 would be a good fund raiser for the project. As of October 24, 1993, over 700 T-shirts have been sold and money raised exceeded $4,000.

Other items were sold including books, calendars, video tapes and bumper stickers. As of October 1, 1993, total money in the E-70 account was $19,456, with a goal of obtaining a total of $23,000 to complete the restoration work.



MilWest Annual Meeting at Deer Lodge, Montana on August 13, 1994. ()Photo by John Chase, Great Falls.

Re-dedication of the E70 at Deer Lodge, Montana in August 1994. (Photo by John Chase, Great Falls, MT)

The E-70 at Deer Lodge, Montana. (Photo by Ed Lynch, August 13, 1994)

Class EF-4 3,000 volt DC ELECTRIC LOCOMOTIVE

A brief history of The Milwaukee Road # E-70

E-70 on display at Deer Lodge, Montana is a proud symbol of the electric era on The Milwaukee Road. "Little Joe" E-70 served on The Milwaukee Road for more than a quarter century. It was built by General Electric in late 1947/48 as one of twenty electric locomotives originally intended for the Soviet Union's Trans-Siberian Railway. The beginning of the Cold War and the breakdown in East-West relations prevented the locomotives from being delivered to Russia. With this situation, General Electric had to find other buyers.

The best potential customer for the motors, which had earned the nickname "Little Joes" — a reference to the Soviet leader Josef Stalin — was The Milwaukee Road. The railroad was able to purchase twelve of these units at bargain prices. This permitted the Milwaukee to update its electrified operations without cutting into the acquisition of diesel engines.

E-70 was the first "Little Joe" to operate on The Milwaukee Road. General Electric converted the unit from 5 foot wide Russian gauge to American Standard gauge of 4 foot 8-1/2 inches. It was then delivered to Harlowton, Montana in December 1948 for a 4-month trial. During this period the engine wore G.E. colors of dark green with white stripe and the number GE-750.

All twelve "Little Joes" were assigned to the Rocky Mountain Division headquartered at Deer Lodge, Montana, and were painted in the Milwaukee Road's then standard colors of Orange, Black and Maroon. Two units were equipped with train heating boilers for use in passenger service. The other Joes, including the E-70, were used exclusively in freight service.

The locomotives did yeoman service for the Milwaukee from 1950-1974. Electric operations were discontinued on June 16th, 1974 and the system was scrapped in favor of an all-diesel opera-

tion. The E-70 was painted, donated to the City of Deer Lodge in 1975 and placed on display near the county courthouse.

Due to 20 years of deterioration at that site, a restoration plan was initiated. "Project E-70" started out as an idea of several ex-employees in 1984 but did not get much attention and only about $300 was raised. The historical group "MILWEST" entered the project in 1992. Working with the Powell County Museum and Arts Foundation over $60,000 was raised to move and paint the locomotive. It was moved to its' present location in October 1983, thanks to a grant obtained through the US Forest Service. Painting was done by J&S Painting Service of Deer Lodge, with details being applied by MilWest members during several volunteer work sessions in 1994.

The E-70 has now been completely restored for future generations to see and enjoy!

Milwaukee Road Class EF-4 Electric # E-70 was cosmetically restored to its' 1950 paint scheme of Orange, Black and Maroon. The project was started in 1992 by the MilWest Historical Group and Powell County Museum and Arts Foundation, owners of the locomotive. Originally the project was to have the E-70 only painted. As time and plans progressed, it was decided to move the E-70 to a better location. In October 1993 the unit was moved by a house moving contractor from its old site near the county courthouse to a new one adjacent to the Old Territorial Prison on Main Street in Deer Lodge, Montana.

Money for the restoration was raised through T-shirt sales and private donations, as well as donations of some materials from numerous Montana businesses. The actual restoration called for the unit to be completely stripped and sandblasted. A local Deer Lodge painting contractor was used to perform this and the paint work. After completion of the paint, the MilWest group performed all detail work to insure technical accuracy.

A re-dedication ceremony was held following the MilWest annual meeting in Deer Lodge on August 12 and 13, 1994.

The Milwaukee Railroad operated their electrification from 1915 to 1974. When built, it was heralded as being the Longest Electrified Railroad in the World! It was initiated to save the railroad money operating over five mountain ranges in Montana, Idaho and Washington. It operated in two sections: from Harlowton, Montana to Avery, Idaho and from Othello, Washington to Seattle on the Pacific Coast. It operated for nearly 60 years, but was designed to last only 30 years. The system was scrapped in 1974 and the railroad operated with all diesel power. In 1977 the Milwaukee Road declared bankruptcy and abandoned their Western Lines in March 1980. At the time it was the largest railroad abandonment in the history of the United States railroads.

List of Facts and Developments

Milwaukee Road E-70 Project

Parties involved: MilWest Historical Group, Ed Lynch, Coordinator
Powell County Museum and Arts Foundation, John Satake, Coordinator
Milwaukee Road Historical Association, Milt Clark, Coordinator
Lines West Division, MRHA, Darrel Dewald, Coordinator

Approximate Figures

Project Inception ..... August 1992
Fund Raising started ..... September 1992
Starting bank account balance $10.00
Money raised through T-shirt and other sales $10,000.00
Money raised through private donations $13,000.,00
Other funds and donation of materials $13,000.00

Moving Contractor, October 18-20, 1994 ..... Sharbono Construction, Helena, MT
Moving Supervisor ..... Jim Branning, Helena, Montana
Cost of E-70 move ..... Approximately $32,000.00

Painting Contractor, April-June 1994 ..... J & H Painting, Deer Lodge, Montana
Painting Supervisor ..... Dave Jette, owner, Deer Lodge, Montana
Cost of painting (including sandblasting and primer) $23,000.00

Work Accomplished by MilWest

#1 — Technical advisors to the contractors and Powell County
#2 — Completely cleaned E-70 prior to painting
#3 — Repaired and replaced broken parts and glass
#4 — Accomplished welding and body work where needed
#5 — Applied all Milwaukee Road Details to include:
- A — New Heralds, Number Boards and Light Fixtures
- B — Copies of original Builders Plates and GE Heralds
- C — All Axle numbers and Main numbers
- D — Re-wired Headlights, Class Lights and Number Boards
- E — Cleaned and painted Locomotive Cab
- F — Documented on video and slides, all activities of the project from beginning to end.

List of Major Contributors

Casey O'Neil
Lake City, Minnesota — $11,000.00

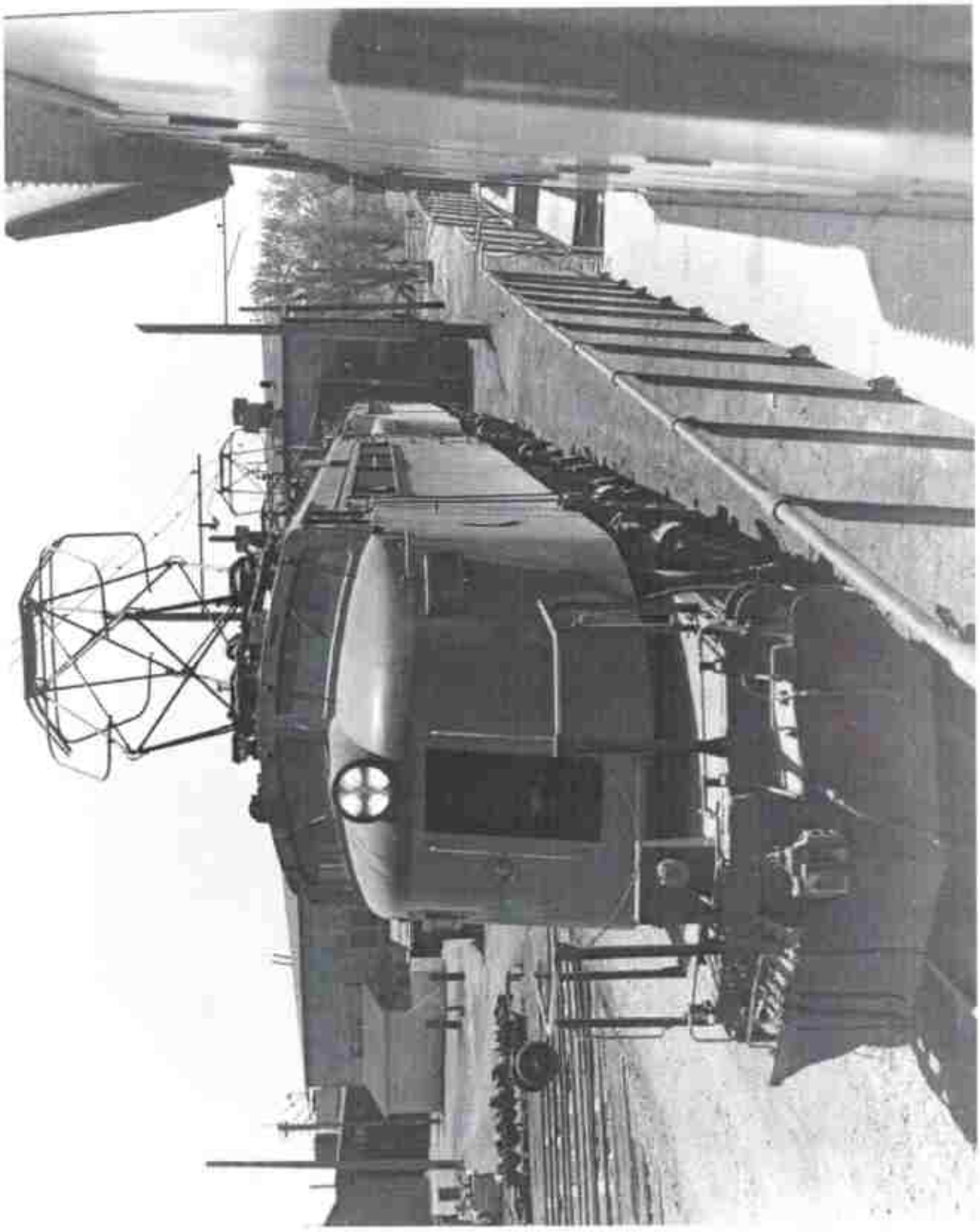
Montana Western Railway
Butte, Montana — Track Donation

DuPont Paint Corporation
Wilmington, Delaware — Paint Donation

Montana Power Company
Butte, Montana — $1,000.00

Columbia Paints
Butte, Montana — Paint Donation

Dean of Signs
Great Falls, Montana — Signs & Lettering



THE LAST JOE to leave Harlowton aat 3:15 p.m. on June 14, 1974 was E-79 and E-71, seen on Track 17 west of the Roundhouse. Engineer Al Patrick. Bill Wilkerson was backing his diesels around to the fuel racks which were located beyond the turntable in the rear. (Bill Wilkerson photo)

TIMES CLARION

PO Box 307
Harlowton, MT 59036-0307
(406) 632-5633
harlotms@mtintouch.net

Larry Wilkerson
5 Ponderosa Drive
Miles City, MT 59301